THE LIBRARY OF THE
UNIVERSITY OF
NORTH CAROLINA

THE COLLECTION OF
NORTH CAROLINIANA
PRESENTED BY

Tennessee Valley Authority

C387
L77t
1963

UNIVERSITY OF N.C. AT CHAPEL HILL
00045076709

This book must not be taken from the Library building.

Form No. 471

C 387
L 72

FLOODS
ON
LITTLE TENNESSEE RIVER
CULLASAJA RIVER
AND
CARTOOGECHAYE CREEK
in Vicinity of
FRANKLIN, NORTH CAROLINA

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

Digitized by the Internet Archive
in 2013

http://archive.org/details/floodsonlittlete00tenn

TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE

April 10, 1963

Colonel Harry E. Brown, Director
State of North Carolina Department of
Water Resources
Post Office Box 9392
Raleigh, North Carolina

Dear Colonel Brown:

In response to the request of the Mayor and Board of Aldermen of Franklin, North Carolina, through the North Carolina Department of Water Resources, TVA has prepared the report, Floods on Little Tennessee River, Cullasaja River and Cartoogechaye Creek in Vicinity of Franklin, North Carolina. The purpose of this report is to provide basic information on floods that have occurred or may occur which would be helpful in the state and local programs of city planning and development at Franklin. We are furnishing you copies of the report for distribution to the appropriate state and city agencies and individuals.

Also, copies of the report are being furnished interested Federal agencies for their information and use.

Sincerely,

TENNESSEE VALLEY AUTHORITY

J. Porter Taylor, Director
Division of Navigation and
Local Flood Relations

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

FLOODS
ON
LITTLE TENNESSEE RIVER
CULLASAJA RIVER
AND
CARTOOGECHAYE CREEK
IN VICINITY OF
FRANKLIN, NORTH CAROLINA

REPORT NO. 0-6193

KNOXVILLE, TENNESSEE
MARCH 1963

CONTENTS

		Page
	Foreword	i
I.	Resume of Flood Situation	1
II.	Past Floods	7
	1. Little Tennessee River Valley	9
	Settlement	9
	The Stream and Its Valley	10
	Developments in the Flood Plain	12
	Bridges across the Stream	17
	Franklin Dam	18
	Obstructions to Flood Flow	22
	Flood Situation	22
	Flood Records	22
	Flood Stages	23
	Flood Occurrences	24
	Duration and Rate of Rise	24
	Velocities	25
	Flooded Areas, Flood Profiles, and Cross Sections	25
	Flood Descriptions	26
	Early Floods	26
	March 1867	26
	February 1875	26
	October 4, 1898	27
	July 1916	27
	August 16, 1928	30
	August 1940	30
	June 16, 1949	31
	March 1952	32
	December 12, 1961	35
	March 1963	35
	2. Cullasaja River Valley	35
	The Stream and Its Valley	35
	Developments in the Flood Plain	36

197261

CONTENTS--(Continued)

Page

Bridges across the Stream 38
Obstructions to Flood Flow 40
Flood Situation 40
Flood Records 40
Flood Stages 41
Flood Occurrences 41
Duration and Rate of Rise 41
Velocities 44
Flooded Areas, Flood Profiles, and Cross Sections 44
Flood Descriptions 44

3. Cartoogechaye Creek Valley 44
The Stream and Its Valley 44
Developments in the Flood Plain 46
Bridges across the Stream 47
Obstructions to Flood Flow 48
Flood Situation 49
Flood Records 49
Flood Occurrences 49
Duration and Rate of Rise 49
Velocities 49
Flooded Areas, Flood Profiles, and Cross Sections 49
Flood Descriptions 50

III. Regional Floods 51
Maximum Known Floods in the Region 51
Determination of Regional Floods 54

IV. Maximum Probable Floods 61
Determination of Maximum Probable Floods 61
Observed Storms 62
Observed Floods 63
Maximum Probable Flood Discharges 64
Frequency 65
Possible Larger Floods 65

CONTENTS--(Continued)

Page

Hazards of Great Floods 65
Areas and Heights of Flooding 66
Velocities and Rates of Rise 66

TABLES

Table		Page
1	Relative Flood Heights--Vicinity of Franklin	6
2	Drainage Areas in Watershed of Little Tennessee River	11
3	Bridges across Little Tennessee River	18
4	Flood Crest Elevations above Bankfull Stage--Little Tennessee River near Prentiss, N. C., 1840-1963	23
5	Highest Known Floods in Order of Magnitude--Little Tennessee River near Prentiss, N. C.	24
6	Monthly Flood Distribution--Little Tennessee River near Prentiss, N. C.	25
7	Drainage Areas in Watershed of Cullasaja River	37
8	Bridges across Cullasaja River	38
9	Flood Crest Elevations above Bankfull Stage--Cullasaja River at Cullasaja, North Carolina, 1898-1963	42
10	Highest Known Floods in Order of Magnitude--Cullasaja River at Cullasaja	43
11	Monthly Flood Distribution--Cullasaja River at Cullasaja	43
12	Drainage Areas in Watershed of Cartoogechaye Creek	46
13	Bridges across Cartoogechaye Creek	48
14	Maximum Known Flood Discharges on Streams in Region of Franklin, North Carolina	52
15	Regional Flood Peak Discharges	56
16	Selected Maximum Observed Storms Transposable to the Region of Franklin, North Carolina	63
17	Selected Maximum Observed Floods	64

PLATES

Plate		Follows Page
1	Upper Little Tennessee River Watershed	10
2	Floods above Bankfull Stage--Little Tennessee River near Prentiss, N. C.	24
3	Stage Hydrograph--Little Tennessee River near Prentiss, N. C.	24
4	Floods above Bankfull Stage--Cullasaja River at Cullasaja, N. C.	42
5	Stage Hydrograph--Flood of August 30, 1940, Cullasaja River at Cullasaja, N. C.	42
6	Maximum Known Flood Discharges--Region of Franklin, N. C.	54
7	Flooded Areas--Little Tennessee River, Vicinity of Franklin, N. C.	68
8	Flooded Areas--Little Tennessee River at Franklin, N. C.	68
9	High Water Profiles--Little Tennessee River, Vicinity of Franklin, N. C.	68
10	Flooded Areas--Cullasaja River and Cartoogechaye Creek, Vicinity of Franklin, N. C.	68
11	High Water Profiles--Cullasaja River and Cartoogechaye Creek, Vicinity of Franklin, N. C.	68
12	Cross Sections--Little Tennessee and Cullasaja Rivers and Cartoogechaye Creek, Vicinity of Franklin, N. C.	68

FIGURES

Figure		Page
1	The Little Tennessee Flood Plain in Franklin	13
2	Main Highway Bridge over Little Tennessee River at Franklin	19
3	N. C. Highway 28 Bridge at Iotla	20
4	Phillips Bridge in Franklin	20
5	Franklin Dam, 3 Miles below the City	21
6	Little Tennessee River Flood of October 4, 1898	28

FIGURES--(Continued)

Figure		Page
7	Vicinity of the Indian Mound, 1963	29
8	Franklin Airport Flooded, June 16, 1949	33
9	U. S. Highway 23, 64, 441 under Water, June 16, 1949	34
10	Cullasaja River Bridge at Mile 1.01 near Franklin	39
11	Bridges over Cartoogechaye Creek	39
12	Super Market on Right Bank of Little Tennessee	57
13	Farm Center Building on U. S. Highway 23, 64, 441	57
14	Hangar and Office at Franklin Airport	58
15	Motel just below U. S. Highway 23, 64, 441 Bridge	58
16	Auto Service Establishments on U. S. Highway 23, 64, 441	59
17	Zickgraf Hardwood Company at Mile 117.15	60
18	Storage Building of Franklin Mineral Products	60

COVER PHOTO

Both approaches to the U. S. Highway 23, 64, 441 bridge over the Little Tennessee River at Franklin were under water on June 16, 1949. This view, looking northeasterly from a knoll on the left bank, is one of three taken by Crisp Studio of Franklin from approximately the same location. The area at the right of the cover picture is shown in Figure 8 and the area at the left in Figure 9. Logs seen in this photograph are being washed away from the stockpile seen in Figure 8.

FOREWORD

Tennessee Valley Authority
Division of Water Control Planning

FOREWORD

This report relates to the flood situation along Little Tennessee River, Cullasaja River, and Cartoogechaye Creek in the vicinity of Franklin, North Carolina. It has been prepared at the request of the Mayor and Board of Aldermen of Franklin through the North Carolina Department of Water Resources to aid (1) in the solution of local flood problems and (2) in the best utilization of lands subject to overflow. The report is based upon work that TVA has been carrying on since its beginning in connection with its water resource operations throughout the Tennessee Valley. TVA has assembled information on rainfall, runoff, historical and current flood heights, and other technical data bearing upon the occurrence and magnitude of floods in localities through the region which provide the basis for preparation of this report.

The report does not include plans for the solution of flood problems. Rather, it is intended to provide the basis for further study and planning on the part of the city of Franklin in arriving at solutions to minimize vulnerability to flood damages. This might involve (1) the construction of flood protection works, (2) local planning programs to guide developments by controlling the type of use made of the flood plain through zoning and subdivision regulations, or (3) a combination of the two approaches.

The report covers three significant phases of the Franklin flood problem. The first brings together a record of the largest known floods of the past on Little Tennessee River, Cullasaja River, and Cartoogechaye Creek. The second treats of Regional Floods. These are derived from consideration of the largest floods known to have occurred on streams of similar physical characteristics in the same general geographical region as that of Little Tennessee River, Cullasaja River, and Cartoogechaye Creek and generally within 50 miles of Franklin. The third develops the Maximum Probable Floods for Little Tennessee River, Cullasaja River, and Cartoogechaye Creek. Floods of this magnitude on most streams are considerably larger than any that have occurred in the past. They are the floods of infrequent occurrence

that are considered in planning protective works, the failure of which might be disastrous. Such floods are used by TVA in the design of the physical features of reservoirs, dams, powerhouses, and local flood protection works.

In problems concerned with the control of developments in the flood plains of Little Tennessee River, Cullasaja River, and Cartoogechaye Creek, and in reaching decisions on the magnitude of floods to consider for this purpose, appropriate consideration should be given to the possible future occurrence of floods of the magnitude of (1) those that have occurred in the past, (2) the Regional Floods, and (3) the Maximum Probable Floods that it is estimated might occur.

The report contains maps, profiles, and cross sections which indicate the extent of flooding that has been experienced and that might occur in the future in the vicinity of Franklin. This should be useful in planning new developments in the flood plains. From the maps, profiles, and cross sections the depth of probable flooding by either recurrence of the largest known floods or by occurrence of the Regional or Maximum Probable Floods at any location may be ascertained. By having this information, floor levels for buildings may be planned either high enough to avoid flood damage or at lower elevations with recognition of the chance and hazards of flooding that are being taken.

I.

RESUME

OF

FLOOD SITUATION

I.

RESUME OF FLOOD SITUATION

Franklin, North Carolina, is located on the Little Tennessee River about 117 miles above the mouth and 27 miles above the head of backwater at normal full-pool level of Fontana Lake. Cullasaja River, a tributary with a drainage area of 93.0 square miles, joins Little Tennessee River within the corporate limits of Franklin. Cartoogechaye Creek, draining 58.4 square miles, has its confluence with Little Tennessee River one mile above the upper corporate limit. The Franklin corporate limits extend for 2.5 miles along Little Tennessee River, from Mile 115.49 to Mile 118.06, and from the mouth to Mile 0.24 along Cullasaja River.

This investigation covers the Little Tennessee River from Mile 110.30 to Mile 119.47, Cullasaja River from the mouth to Mile 4.24, and Cartoogechaye Creek from the mouth to Mile 5.38. The total drainage area of Little Tennessee River above the lower limit of the reach studied is 323 square miles.

Franklin Dam, a small hydroelectric development owned by the Nantahala Power and Light Company, is located on Little Tennessee River about 3 miles below Franklin and, at normal full-pool level, backs water through the town and beyond the upper corporate limit.

The principal business and residential development of Franklin is on high ground west of Little Tennessee River, but there are important industrial and commercial developments on land along the stream. Portions of this land have been inundated by floods of the past and a substantially greater area is within reach of the greater floods of the future.

Records of river stages and discharges have been maintained on the Little Tennessee River in the vicinity of Franklin continuously since 1929. Intermittent records go back to 1907 when a staff gage was installed near the present site of U. S. Highway 23, 64, 441 bridge. On Cullasaja River records are continuous since 1921 and intermittent since 1907. Streamflow records were begun on Cartoogechaye Creek in June 1961. In compiling a record of early floods on the three streams, it has been necessary to interview residents

along the streams who have knowledge of past floods and to conduct research in newspaper files and historical documents. From these investigations and from the studies of possible future floods on Little Tennessee River, Cullasaja River, and Cartoogechaye Creek in the vicinity of Franklin, the flood situation, both past and future, has been developed. The following paragraphs summarize the significant findings with regard to the flood situation which are discussed in more detail in succeeding sections of this report.

THE GREATEST FLOOD known to have occurred on the Little Tennessee River at Franklin and on the Cullasaja River within the past 65 years was on August 30, 1940. On Cartoogechaye Creek the June 16, 1949, flood is the highest of which there is definite knowledge.

* * *

THREE GREAT FLOODS on Little Tennessee River occurred in October 1898, July 1916, and June 1949. At the Prentiss gage, these equaled or exceeded the August 30, 1940, flood, but in Franklin they were lower than that flood. At the Iotla gage the crests of the 1898 and June 1949 floods were equal and 0.5 foot lower than the August 30, 1940, flood. On Cullasaja River, at the stream gage, the 1916 and 1949 floods were about $3\frac{1}{2}$ feet lower than the 1940 flood; however, over most of the reach the 1949 flood was only 2 feet lower than the 1940 flood. Floods other than the June 1949 flood most likely occurred on Cartoogechaye Creek, but no information is known about them.

* * *

OTHER LARGE FLOODS on Little Tennessee River occurred in March 1952 and December 1961. On Cullasaja River large floods occurred in August 1928, September 1936, August 13, 1940, and March 1952. The only significant rise since the gage was established on Cartoogechaye Creek in June 1961 occurred on December 12, 1961, and was 4 to 5 feet lower than the June 1949 flood.

* * *

REGIONAL FLOODS on Little Tennessee River, Cullasaja River, and Cartoogechaye Creek in the vicinity of Franklin are based upon floods experienced on streams generally within 50 miles of the town. This indicates that greater floods than those experienced so far may reasonably be expected in the future. Based upon the magnitude of floods that have occurred on the neighboring streams, a Regional Flood may occur on the Little Tennessee River at Franklin that would be generally 11 feet higher than the August 30, 1940, flood. A Regional Flood on the Cullasaja River would reach stages generally 12 feet higher than the August 30, 1940, flood. On Cartoogechaye Creek the Regional Flood would be generally 10 feet higher than the June 1949 flood.

* * *

MAXIMUM PROBABLE FLOOD determinations indicate that floods could occur on Little Tennessee River in the vicinity of Franklin about 21 feet higher than the August 30, 1940, crest. A Maximum Probable Flood on Cullasaja River would be about 18 feet higher than the August 30, 1940, flood crest. On Cartoogechaye Creek a Maximum Probable Flood would be about 20 feet higher than the June 1949 flood.

* * *

FLOOD DAMAGES that would result from a recurrence of a flood as large as that of August 30, 1940, would be substantial because of the development in the flood plain at Franklin. Occurrence of a Regional or Maximum Probable Flood, with their greater depths and velocities, would cause extensive damages. Damages to roads, bridges, and agricultural lands along Little Tennessee River, Cullasaja River, and Cartoogechaye Creek would be severe.

* * *

MOST FREQUENT FLOOD OCCURRENCES on Little Tennessee River, Cullasaja River, and Cartoogechaye Creek have been in the winter and early spring. However, floods also occur on these streams in the summer and fall months.

* * *

VELOCITIES OF WATER during the August 30, 1940, flood ranged up to 9 feet per second in the channel of the Little Tennessee River in the Franklin vicinity and up to 3 feet per second in the flood plain. On Cullasaja River the channel velocities during the same flood ranged up to 11 feet per second and the flood-plain velocities up to 4 feet per second. On Cartoogechaye Creek the channel velocities in the June 1949 flood ranged up to 10 feet per second and the overbank velocities up to 3 feet per second. During a Maximum Probable Flood, velocities on the Little Tennessee River would range up to 22 feet per second in the channel and up to 6 feet per second in the flood plain. The corresponding velocities on the Cullasaja River would be 16 and 8 feet per second and on Cartoogechaye Creek 26 and 6 feet per second.

* * *

DURATION OF FLOODS is relatively short on all streams in the vicinity of Franklin. During the flood of August 30, 1940, the Little Tennessee and Cullasaja Rivers remained above bankfull stage 16 to 18 hours. The rate of rise during this flood averaged 0.4 foot per hour on the Little Tennessee River and 1 foot per hour on the Cullasaja River. During a Maximum Probable Flood on Little Tennessee River, the stream would rise about 32 feet in 16 hours, with a maximum rate of rise of 4 feet per hour, remaining out of banks for about 2 days. On Cullasaja River the Maximum Probable Flood would rise about 34 feet in 12 hours with a maximum rate of rise of 6 feet per hour, remaining out of banks $1\frac{1}{2}$ to 2 days. On Cartoogechaye Creek a Maximum Probable Flood would rise about 36 feet in 10 hours, remaining out of banks for about 1 to $1\frac{1}{2}$ days.

* * *

HAZARDOUS CONDITIONS are to be expected during very large future floods as a result of rapidly rising streams, high velocities, and deep flows.

* * *

FUTURE FLOOD HEIGHTS that would be reached if floods of the magnitude of the Regional and Maximum Probable occurred in the vicinity of Franklin are shown for three locations in Table 1. The table compares these heights with the crest of the maximum known flood at each location.

TABLE 1

RELATIVE FLOOD HEIGHTS

VICINITY OF FRANKLIN

Flood	Location	Mile	Estimated Peak Discharge cfs	Above 1940 or 1949 feet
	Little Tennessee River			
August 30, 1940	U. S. Hwy. 23, 64, 441 (E. Main Street)	116.55	18,000	0
Regional			62,000	12.0
Maximum Probable			111,000	20.6
	Cullasaja River			
August 30, 1940	at Cullasaja (USGS stream gage)	4.24	16,500*	0
Regional			33,000	8.2
Maximum Probable			56,000	13.5
	Cartoogechaye Creek			
June 1949	Former U. S. Hwy. 23,441 (USGS stream gage)	1.95	7,000	0
Regional			26,000	12.4
Maximum Probable			48,000	21.3

*See explanation on page 62.

II.

PAST FLOODS

II.

PAST FLOODS[1]

This section of the report is a history of floods which have occurred on the Little Tennessee River and its tributaries, Cullasaja River and Cartoogechaye Creek, in the vicinity of Franklin, in Macon County, North Carolina. The portion of the Little Tennessee River considered extends from N. C. Highway 28, at Mile 110.30, to the Prentiss stream gage at Mile 119.47, about $1\frac{1}{2}$ miles upstream from Franklin, a distance of 9.17 river miles. The investigation on Cullasaja River covers the 4.24 miles from its confluence with Little Tennessee River to a point just above U. S. Highway 64, at Cullasaja. Cartoogechaye Creek is covered from the mouth to a point near Carson Chapel, Mile 5.38. Cullasaja River joins Little Tennessee River at Mile 117.36, in Franklin. Cartoogechaye Creek joins Little Tennessee River just upstream from Franklin, at Mile 119.02. The study reaches are all in Macon County. The drainage areas of both Cullasaja River and Cartoogechaye Creek are wholly within Macon County. About one-fifth of the drainage area of Little Tennessee River above Franklin lies in Rabun County, Georgia.

The Little Tennessee River flows generally northward in the reach covered by this report. Cullasaja River flows generally northwestward and Cartoogechaye Creek flows eastward to the confluences of both streams with Little Tennessee River. Wide bottom lands alternate with narrow reaches along all three streams. About three miles below Franklin on the Little Tennessee River is Franklin Dam, which forms Lake Emory. At full-pool elevation, backwater from the dam extends upstream for about five miles, a short distance above the upper corporate limit of Franklin. The principal business and residential sections of Franklin are on high ground west of the Little Tennessee River, but there are important industrial and commercial developments on both sides of the flood plain in the vicinity of U. S. Highway 23, 64, 441 and on the left bank between the highway and the mouth of Cullasaja River. Franklin Airport, on the right-bank flood plain, is subject to overflow.

---

1. Prepared by Hydraulic Data Branch

The first records of river stage and discharge in the vicinity of Franklin date from 1907, when the U. S. Geological Survey installed staff gages on Little Tennessee River near the present U. S. Highway 23, 64, 441 bridge and on Cullasaja River near the present U. S. Highway 64 bridge at Cullasaja. Sizable gaps exist in the early streamflow records, but they are continuous for the Little Tennessee River since June 1929, when a recording stream gage began operating at Iotla, $2\frac{1}{2}$ miles downstream from Franklin Dam. A recording gage installed at Prentiss, above Franklin, has operated continuously since June 1944. Since October 1954, an auxiliary water-stage recorder has been operated about 0.4 miles downstream from the Prentiss gage. Records were discontinued at the Iotla gage in September 1945. Records of stage and discharge are complete since February 1921 for the Cullasaja River at Cullasaja. The station operated as a staff gage until May 1934 and as a recording gage since that date. A recording stream gage has been operated on Cullasaja River at Highlands since December 1927. For Cartoogechaye Creek streamflow records are available since June 1961, when a recording gage was installed at the old U. S. Highway 23 and 441 bridge 1.8 miles south of Franklin.

Flood history investigations which were made by TVA engineers in the period 1935 to 1937 developed information on the Little Tennessee River from Franklin downstream. Investigations were made following the large floods in August 1940 and June 1949. Local residents have been interviewed. Field investigations have been made to supplement the early data and to develop in detail the flood profile for the largest recent flood on the three streams, that of December 12, 1961. A search has been made of newspaper files and historical documents. From these sources it has been possible to develop a history of the known floods on Little Tennessee River, Cullasaja River, and Cartoogechaye Creek covering the past 65 years or more.

This section of the report discusses separately the flood history of the three streams.

1. LITTLE TENNESSEE RIVER VALLEY

Settlement

The land which now constitutes Macon County was probably first seen by the white man when DeSoto passed through the section in 1540. This was Cherokee Indian land until the North Carolina General Assembly declared it open to settlement by the white man in 1783. Buncombe County, which was formed in 1792, at first contained all the land in North Carolina lying west of the Blue Ridge. The portion now included in Haywood, Macon, Jackson, Swain, Graham, Clay, and Cherokee counties was broken off and made Haywood County in 1808, with Waynesville as the county seat. Surveys of the territory were made and the parcels of land were offered for sale at auction in September 1820 at Waynesville. Macon County was formed in 1828 and named for Nathaniel Macon, a statesman and hero of the Revolutionary War.

Franklin is located at the site of Nikwasi, one of the old Cherokee towns used by the Indians until 1819. One of their ceremonial mounds still stands on the flood plain of Little Tennessee River at the side of U. S. Highway 23, 64, 441 and is one of the landmarks of the town. Franklin was named for Jesse Franklin, Governor of North Carolina from 1820 to 1821, and one of the North Carolina Commissioners who conducted the territorial survey. The town was incorporated in 1855.

In its early years Franklin had strong ties to North Georgia because of the easier access to that area. In the 1850's there was much discussion of a railroad to connect Anderson, South Carolina, with Knoxville, Tennessee, by way of Rabun Gap, Franklin, and a route down the Little Tennessee River, but other routes proved more advantageous. A rail line, the Tallulah Falls Railroad, reached Clayton from the south in 1904, and in 1907 the line was completed to Franklin, giving the area a tie to the main-line system of the Southern Railway at Cornelia, Georgia. The line had financial difficulties for most of its existence, but it nevertheless had a considerable effect upon the economy of the region, taking pulpwood and lumber products to the outside markets and bringing in products for local use. Passenger service was discontinued on the line in 1946 and the railroad was granted permission to abandon its operations and sell its equipment in November 1960.

U. S. Highway 23 and 441 now provides excellent north-south service through Franklin. Motor freight and bus lines use this highway, and tourist travel to and from the Great Smoky Mountains National Park by this route is increasing each year. U. S. Highway 64 passes through Franklin and the scenic mountain areas which lie to the east and west.

According to the 1960 census report the population of Franklin is about 2,200 persons and Macon County 14,900 persons.

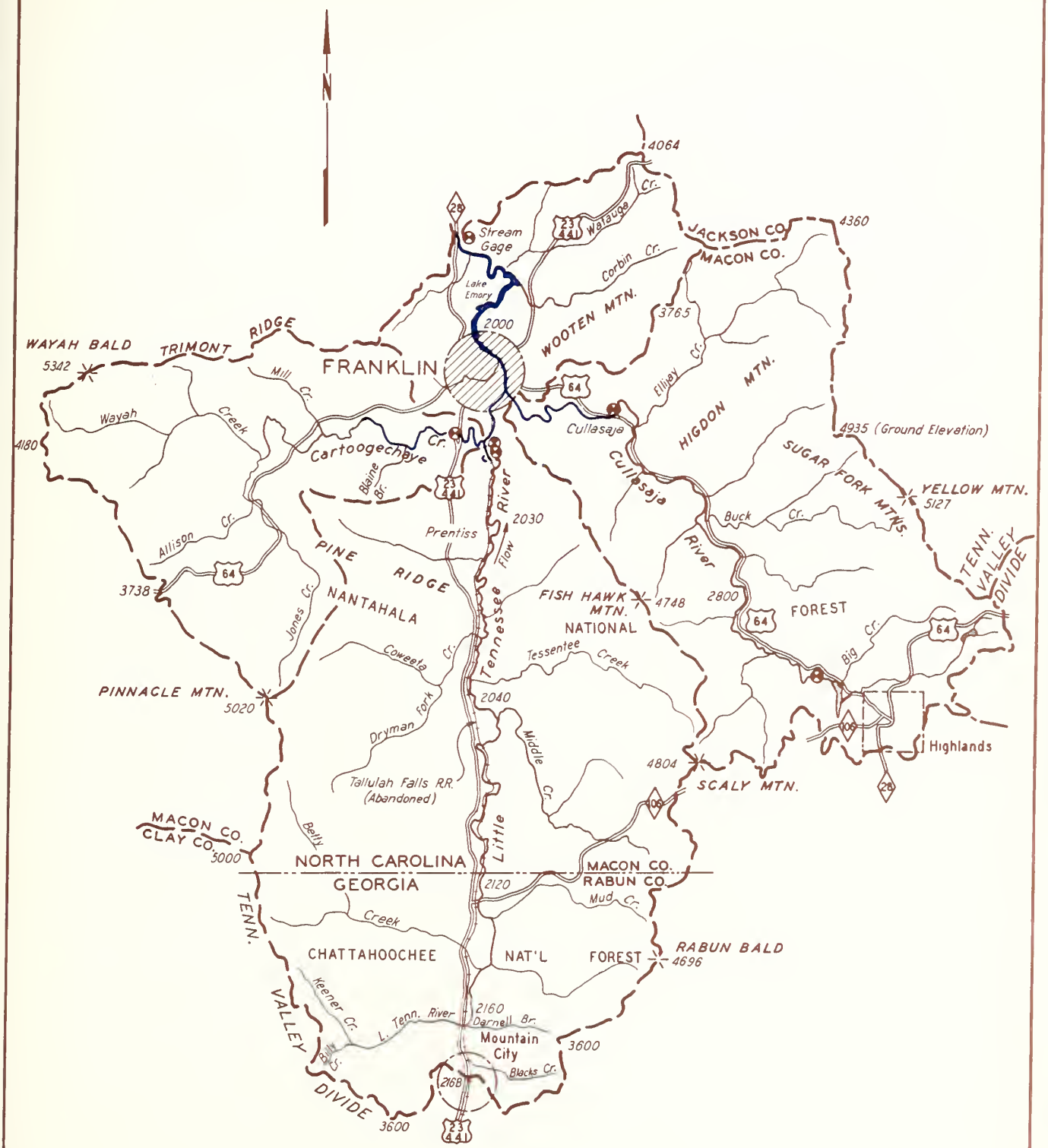
The Stream and Its Valley

The Little Tennessee River drains an area of 2,627 square miles, part of which lies in Georgia, part in North Carolina, and part in Tennessee. The Little Tennessee River watershed above Iotla, near Franklin, with a drainage area of 323 square miles, is shown on Plate 1.

The drainage area above Iotla comprises gentle to rugged mountain land, lying in Macon County, North Carolina, and Rabun County, Georgia. Its shape is roughly that of a square, 18 miles on a side and with the sides oriented in northeast-southwest and northwest-southeast directions. Little Tennessee River has its head near Mountain City, Georgia, at the south corner of the watershed, and flows generally northward through Franklin to Iotla, at the north corner of the area. Cullasaja River, the largest tributary in this reach of Little Tennessee River, heads up in the east corner and flows northwestward, then westward to join Little Tennessee River at Franklin. Cartoogechaye Creek, the second largest tributary, heads at the west corner of the watershed and flows to the east to join the river just above Franklin. Hence, the three principal streams of the drainage system converge at Franklin, causing a rapid concentration of runoff at that point in time of flood. Cullasaja River and Cartoogechaye Creek will be discussed in later sections of the report. Pertinent drainage areas of Little Tennessee River and its tributaries in the vicinity of Franklin are given in Table 2.

Little Tennessee River is formed near Mountain City, Georgia, by the confluence of Keener and Billy Creeks. Blacks, Betty, Darnell, and Mud Creeks join the stream near Dillard to complete the principal drainage system in the Georgia portion of the watershed. Between the Georgia - North Carolina state line and the mouth of Cartoogechaye Creek, numerous small streams rise

PLATE I



REACH COVERED BY THIS REPORT

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

UPPER LITTLE TENNESSEE RIVER WATERSHED

SCALE 0 1 2 3 4 5 MILES

MARCH 1963

TABLE 2

DRAINAGE AREAS IN WATERSHED OF LITTLE TENNESSEE RIVER

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Little Tennessee River	Mouth	0.0	2627
	Fontana Dam	61.0	1571
	Lower limit of study (N. C. Highway 28)	110.30	323
	Former USGS stream gage at Iotla	110.51	323
	Franklin (Porters Bend) Dam	113.10	310
	U. S. Highway 23, 64, 441 (East Main Street)	116.55	295
	Below Cullasaja River	117.36	294
	Above Cullasaja River	117.36	201
	Below Cartoogechaye Creek	119.02	198±
	Above Cartoogechaye Creek	119.02	139±
	Upper limit of study (Prentiss stream gage)	119.47	140
Cullasaja River	Mouth	0.0	93.0
Cartoogechaye Creek	Mouth	0.0	58.4

along the basin rim and flow generally at right angles to the main stream. The largest of these are Coweeta and Tessentee Creeks, with drainage areas of approximately 17 and 15 square miles, respectively. Below Cartoogechaye Creek and Cullasaja River the tributary streams are small and do not appreciably affect flood peaks.

Elevations around the watershed rim in Georgia range from 2168 feet in Mountain City to 4696 feet at Rabun Bald, and are generally over 3000 feet. In the North Carolina portion of the watershed much of the rim is above 4000 feet. Pinnacle Mountain, at the west side of the basin, is over 5000 feet, and Scaly Mountain and Fishhawk Mountain, on the east side, are near 4800 feet elevation.

From Mountain City to Prentiss the valley floor drops from 2120 to 2030 feet, a fall of 90 feet in a straight-line distance of 13 miles and a river-channel distance of about 20 miles, an unusually low rate of fall for a stream in mountainous terrain.

In the reach of Little Tennessee River covered by this investigation the slope of the stream channel averages about 5.5 feet per mile. The flood plain varies in width from 400 to more than 2000 feet, the greatest width being in the developed section at Franklin, between Phillips Bridge and U. S. Highway 23, 64, 441. The narrowest sections are above the Franklin corporate limit. Between U. S. Highway 23, 64, 441 and Franklin Dam the flood plain is occupied by Lake Emory, with widths generally between 500 and 800 feet. Between the dam and Tippet Branch, Mile 111.48, the flood plain is 400 to 700 feet wide. Near Rocky Branch, Mile 111.15, the valley widens to 1200 feet, then narrows to about 500 feet at N. C. Highway 28.

The corporate limits of Franklin form a circle with a radius of one mile including the reach of the Little Tennessee River between Miles 115.49 and 118.06. The principal business and residential sections are on high ground, but some industrial and commercial developments are subject to flooding.

Developments in the Flood Plain

Plates 7 and 8 show the flood plain of Little Tennessee River for the reach covered by this investigation. Figure 1 shows views of the flood plain in Franklin. Except for the land inundated by the reservoir above Franklin Dam and that in the immediate Franklin area, use of land in the flood plain is principally agricultural.

U. S. Highway 23, 64, 441 crosses the Little Tennessee River flood plain at East Main Street in Franklin, Mile 116.55. U. S. Highway 64 follows the edge of the right-bank flood plain upstream to Cullasaja River, then follows that stream east and south toward Highlands. N. C. Highway 28 crosses the river and flood plain at Iotla, at the lower end of the reach. Secondary roads follow the right bank of the river for short distances at Iotla and near Franklin Dam. Depot Street, Riverview Street, and Lakeside Drive, in Franklin, follow the river in the flood plain. Portions of three other streets, Wayah Street, Uleo Drive, and Clark Chapel Road, are in the flood plain in the vicinity of

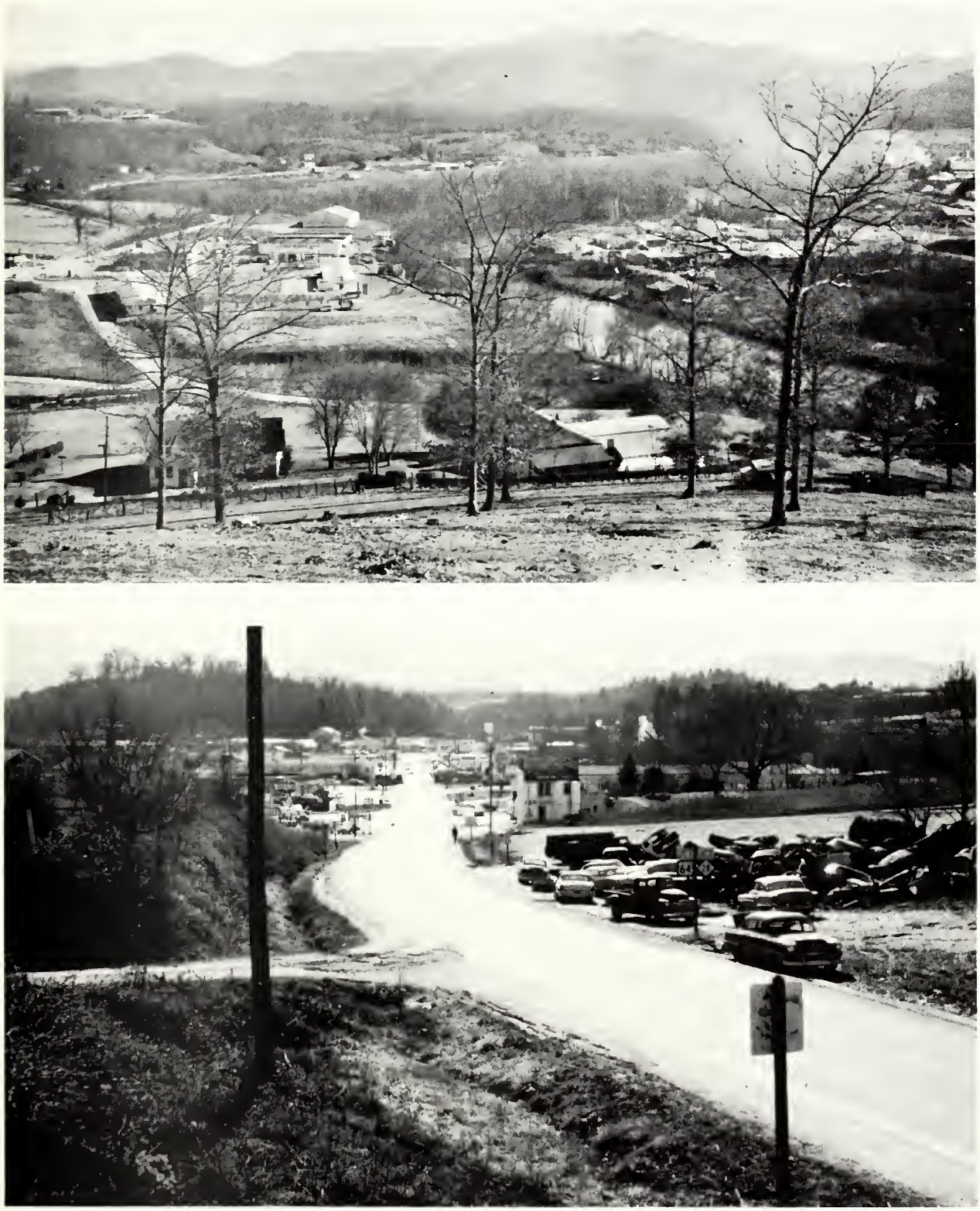


Figure 1. --THE LITTLE TENNESSEE FLOOD PLAIN IN FRANKLIN

Upper view is south or upstream from the hillside on right bank of river. The main highway bridge is partly concealed by treetops in center of picture. Motel shown in Figure 15 is at left center, and the airport is in background. Lower view is southwest along East Main Street (U. S. Highway 23, 64, 441) from a point about 1300 feet from the bridge, which can be seen in background.

Phillips Bridge. Highway planning studies being made for the Franklin area envision a loop road, roughly following the corporate limit south and east of town, to allow through traffic to bypass the heart of the town. The road would connect with U. S. Highway 64 just west of Franklin, have an interchange with U. S. Highway 23 & 441 south of town, cross the river about Mile 118.2, interchange with U. S. Highway 64 to the east, and join U. S. Highway 23 & 441 in the northeast part of Franklin.

During the period it was in operation, the Tallulah Falls Railroad followed the left-bank flood plain from Main Street through the upper end of the reach covered by this investigation. The tracks were taken up for salvage after the railroad ceased operations in 1960.

Commercial and industrial developments on the Little Tennessee River at Franklin are found on both sides of the flood plain in the vicinity of the U. S. Highway 23, 64, 441 bridge along East Main Street, on the left bank near Phillips Bridge, and along Depot Street which follows the left bank between these two bridges. Land which is between the old railroad grade and the river in this area is mostly low and swampy and generally is undeveloped. Between the railroad and Depot Street the land is generally higher or has been improved by filling to provide sites for the developments which are now found there.

Peak Line Furniture Manufacturing, Incorporated, makers of tables, have their plant on the left-bank flood plain just above Phillips Bridge, at Mile 117.75. The floor of the plant is at elevation 2013.6 feet, about two feet under the crest elevation of the flood of August 30, 1940. However, the plant is protected from floods approximately to elevation 2016.5 feet by the fill for the tracks of the now abandoned Tallulah Falls Railroad, plus a dike which leads from the fill to high ground at the downstream side of the plant property. Drainage from behind the dike is carried off by a culvert at the lower corner of the property. A valve in the culvert may be closed to prevent the entrance of backwater. The railroad fill and dike are 11 feet lower than the Regional Flood and 19 feet below the elevation of the Maximum Probable Flood.

The Zickgraf Hardwood Company, Incorporated, located between Depot Street and the old railroad grade at Mile 117.15, produces hardwood lumber and flooring. The low point in the plant area is a furnace room about

6 feet above the crest height reached in the flood of August 30, 1940, but 6 feet lower than the Regional Flood and 15 feet below the elevation of the Maximum Probable Flood. The main floor of the plant is 3.6 feet higher than the furnace room and lumber storage areas are somewhat above the plant floor elevation.

Property of the Nantahala Lumber Company adjoins that of the Zickgraf firm at the downstream side. The plant, which produces and supplies lumber and timber products, has its principal storage floor about 9 feet above the August 30, 1940, flood crest elevation, but 3 and 12 feet, respectively, below the elevations of the Regional and Maximum Probable Floods.

The Franklin Mineral Products Plant, located just downstream from the Nantahala Lumber Company, grinds and processes mica. The furnace room floor is 6 feet above the August 30, 1940, flood but 6 feet lower than the Regional Flood and 14 feet below the elevation of the Maximum Probable Flood. The plant floor is 3.5 feet higher than the furnace room.

Other establishments located along Depot Street include a ready-mix concrete plant, a propane gas bulk plant, a hardware distributor, a machine and equipment repair shop, a blacksmith shop, a woodworking shop, and an auto repair shop.

The commercial developments located on both banks of the river along Main Street have for the most part been established since the last large flood, that of June 1949, and are on land which has been raised by filling. Catering principally to traffic along U. S. Highway 23, 64, 441 are three motels, two restaurants, and seven service stations. Also in the flood plain are three bulk oil plants, two feed and farm supply stores, a concrete products plant, a grading contractor, a tire recapping firm, two dry cleaners, two real estate offices, an electric shop, a roller skating rink, and a supermarket.

The Franklin Airport is located on the right-bank flood plain. A sodded runway, which extends for a 2700-foot distance along the flood plain, Mile 116.8 to Mile 117.35, is low and subject to frequent flooding. The floor of the administration building, on somewhat higher ground near U. S. Highway 64, is 0.4 foot higher than the August 30, 1940, flood and 11 and 20 feet, respectively, below the elevations of the Regional and Maximum Probable Floods. The main hangar floor is 3.2 feet higher than the administration building floor.

In the reach under investigation on the Little Tennessee River, the Maximum Probable and Regional Floods would affect about 140 and 90 buildings, respectively.

Franklin obtains its water supply from wells and presently has some ten wells in its system. Two wells are in the flood plain of Little Tennessee River and two are located adjacent to the flood plain. The T. W. Angel well, located near the corner of Main and Roger Streets, is put out of operation during large floods. The top of well casing is 0.2 foot higher than the August 30, 1940, flood, and 12 and 20 feet, respectively, lower than elevations of the Regional and Maximum Probable Floods. In time of flood the well is taken out of service and the pump motor is raised for protection against damage. The Elbert Angel well, located near the intersection of Wayah and Depot Streets, is used intermittently. The top of the well casing is 15 feet above the crest height for the August 30, 1940, flood, 3 feet above the Regional Flood, but 5 feet below the elevation of the Maximum Probable Flood. The John Higdon well, at the edge of the right-bank flood plain near the Franklin Airport, has its top of casing about 4 feet higher than the August 30, 1940, flood crest but 8 and 16 feet, respectively, lower than the Regional and Maximum Probable Floods. The top of well casing of the McConnell well on Iotla Street is about 20 feet above the August 30, 1940, flood, 10 feet above the Regional Flood, and 3 feet above the Maximum Probable Flood. The other wells in the system are located on high ground away from the river.

Franklin has had an engineering study made to investigate supplies available to meet the anticipated future water needs of Franklin. The report recommended construction of an intake and water treatment plant on Cartoogechaye Creek south of the Franklin corporate limit, near the U. S. Highway 23 & 441 bridge.

Franklin municipal sewers now discharge untreated waste into Little Tennessee River at five points. Sewage which has had primary treatment enters the river at one other point. A number of privately built lines discharge directly into the river. A study which has been made for the town to determine the needs to meet the sewage treatment standards set by the North Carolina Stream Sanitation Commission has recommended a sewage treatment plant to be built on the left-bank flood plain just downstream from

the lower corporate limit with a collecting sewer extending upstream to Wayah Street.

Bridges across the Stream

Three highway bridges cross Little Tennessee River in the reach investigated. Table 3 lists pertinent elevations for the bridges and shows the relation to the crest of the flood of August 30, 1940. Figures 2, 3, and 4 are photographs of the bridges. Plate 9 shows the relation of the floor and underclearance at the bridges to the flood profiles for the reach. Two of the bridges are overtopped or cut off from use by overflow in all major floods. The other has an underclearance sufficiently high to pass the highest known floods on Little Tennessee River, but would be overtopped by a Maximum Probable Flood.

North Carolina Highway 28, which crosses Little Tennessee River at Mile 110.30, carries local traffic plus through traffic between Franklin and Bryson City. The bridge is a seven-span structure with concrete piers, steel girders, wood floor and guard rails, and a black-top road surface. A fill averaging 15 feet in height blocks the 600-foot flood plain on the left bank. The right-bank flood plain, about 300 feet wide at this point, is blocked by a lower fill and the fill of a connecting road.

The bridge at East Main Street in Franklin, Mile 116.55, carries heavy local traffic as well as all the through traffic on U. S. Highway 23, 64, 441. This is a reinforced concrete structure with five spans A solid guard rail adds to the restrictive effect of the bridge. Fill for the highway approaches, along with the general filling which has been done in connection with the commercial developments which line both sides of the highway, averages about four feet over the original flood-plain elevation on both banks of the stream. Traffic over the bridge is affected when overflow of the bridge approaches begins at elevation 2010.5 feet. The floods of August 1940 and June 1949 both overflowed the bridge approaches.

Phillips Bridge at Mile 117.57 carries local rural and urban traffic via Clark Chapel Road. This is a single-span steel truss bridge. An approach fill on the left bank averages about 5 feet high. On the right bank the approach fill is 2 or 3 feet high and is overflowed at elevation 2010 feet. Backwater from Franklin Dam extends beyond Phillips Bridge at normal full-pool level. The

TABLE 3

BRIDGES ACROSS LITTLE TENNESSEE RIVER

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Aug. 30, 1940 Flood Crest Elev. feet	Underclearance Elev. feet	Underclearance Above Aug. 30, 1940 feet	Underclearance Below Aug. 30, 1940 feet
110.30	NC Hwy 28	1956.8	1977.9	1985.2	1970.7	1974.5	3.8	
116.55	US Hwy 23, 64, 441 (E. Main Street)	2000.2	2013.9	2024.0	2012.0	2009.6		2.4
117.57	Phillips Bridge	2000.7	2012.3	2027.1	2015.1	2010.6		4.5

State Highway Commission is planning to replace Phillips Bridge with a new structure opposite Wayah Drive, about 700 feet downstream, with a right-bank approach fill connecting to Clark Chapel Road.

Franklin Dam

Franklin Dam, Figure 5, also known locally as Porters Bend Dam, is a concrete masonry structure at Mile 113.11, built by the town of Franklin in 1925. Purchased by the Nantahala Power and Light Company in 1933, it is now operated as part of the company's electric generating system. The dam is 462 feet long, and has a maximum height of 35 feet and an effective height of 26 feet. Six Tainter gates 25 feet wide by 10 feet high regulate discharge at the dam. Two fixed spillway bays at each end of the Tainter gate section provide additional spillway capacity. The dam was altered in 1944 to raise the pool level one foot. Float-operated controls and electric gate hoists give a degree of automatic spillway gate operation. A powerhouse at the right end of the dam contains two generating units rated at 650 kva each. Backwater from the dam, at top-of-gate elevation, extends upstream to Mile 118.5, beyond the upper corporate limit of Franklin, a distance of 5.4 river miles. The reservoir is now almost completely filled with sediment, so that normally water is only 2 or 3 feet deep over much of the reservoir.

Figure 2. --MAIN HIGHWAY BRIDGE OVER LITTLE TENNESSEE RIVER AT FRANKLIN

View from right bank toward bridge which carries U. S. Highway 23, 64, 441. The river here, at Mile 116.55, is in backwater from Franklin Dam 3.4 miles downstream.

Figure 3. --N. C. HIGHWAY 28 BRIDGE AT IOTLA

The view is from right bank of the Little Tennessee River at Mile 110.30. The bridge has steel girders and a black-topped wood floor.

Figure 4. --PHILLIPS BRIDGE IN FRANKLIN

The view is upstream from left bank of the Little Tennessee River at Mile 117.57.

Figure 5. --FRANKLIN DAM, 3 MILES BELOW THE CITY

This dam at Mile 113. 10, otherwise known as Porters Bend Dam, is operated by the Nantahala Power and Light Company. Backwater from the dam at normal full pool extends beyond the upper corporate limit of Franklin.

Obstructions to Flood Flow

The effect of obstructions due to the bridges and the approach fills which cross the flood plain have been discussed previously. The extensive filling which has been done through the developed reach in Franklin has caused a further constriction of flood flows. The backwater effect of Franklin Dam and the loss of stream channel area due to sediment deposits in the reservoir serve to alter flood profiles to some extent.

FLOOD SITUATION

Flood Records

Records of river stage and discharge on Little Tennessee River in the vicinity of Franklin are continuous since 1929. Intermittent records go back to June 12, 1907, when a staff gage was installed by the U. S. Geological Survey near the present U. S. Highway 23, 64, 441 bridge in Franklin. This gage was discontinued July 11, 1910. A chain gage was installed at the site February 9, 1921, and observed until November 11, 1925, when backwater from the newly constructed Franklin Dam affected the readings. Observations were made at a staff gage at Etna, North Carolina, 13.5 miles downstream from Franklin, from January 7, 1926, to December 31, 1929. A recording stream gage began operating at Iotla, 6 miles below Franklin, on June 28, 1929. Records were continued at this site until September 30, 1945. The Geological Survey recording stream gage, Little Tennessee River near Prentiss, located at Mile 119.47 or 1.4 miles above the upper Franklin corporate limit, began operating June 15, 1944, and has been operated continuously since that date. Since October 1954 an auxiliary water-stage recorder has operated at a site about 0.4 mile downstream from the Prentiss gage.

To supplement the record obtained at these gaging stations, local residents have been interviewed for information on dates and heights of floods. Files of the Franklin newspapers have been searched. Valuable data were obtained from reports of field investigations made by TVA engineers after the important floods which have occurred in the last 28 years. High-water marks were located in the field to develop in detail the flood-crest profile for the flood of December 12, 1961. These records and investigations have developed a knowledge of floods on Little Tennessee River covering the past 65 years or more.

TABLE 4

FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE
LITTLE TENNESSEE RIVER NEAR PRENTISS, N. C.
1840-1963

This table includes all known floods above bankfull stage of 9 feet at the U. S. Geological Survey gaging station near Prentiss, Mile 119.47. Drainage area is 140 square miles.

Date of Crest	Gage Heights	
	Stage feet	Elevation feet
May 1840	(a)	
March 1867	(a)	
February 1875	(a)	
October 4, 1898	15 (b)	2023
February 1902	(a)	
November 1906	(a)	
July 1916	12.5 (b)	2020.9
December 26, 1929	9.4	2017.8
December 28 1932	9.2	2017.6
April 6, 1936	9.5 (b)	2017.9
September 30, 1936	9.8	2018.2
August 30, 1940	12.5 (b)	2020.9
December 29, 1942	9.9	2018.3
February 10, 1946	9.33	2017.72
January 20, 1947	9.20	2017.59
November 29, 1948	9.41	2017.80
June 16, 1949	12.85	2021.24
March 11, 1952	10.54	2018.93
March 23, 1952	10.48	2018.87
February 21, 1953	9.64	2018.03
January 22, 1954	9.28	2017.67
April 15, 1956	9.09	2017.48
April 5, 1957	9.76	2018.15
February 25, 1961	9.47	2017.86
December 12, 1961	10.17	2018.56
March 13, 1963	9.00	2017.39

(a) Stage unknown--Flood history investigations indicate that floods occurred at this time.
(b) Estimated from high-water mark.

Flood Stages

Peak stages are given in Table 4 for known floods which have exceeded the bankfull stage of 9 feet on the Little Tennessee River at the Prentiss stream gage. Table 5 lists the highest five floods in order of magnitude. For the period 1944 to

TABLE 5

HIGHEST KNOWN FLOODS IN ORDER OF MAGNITUDE

LITTLE TENNESSEE RIVER NEAR PRENTISS, N. C.

Order No.	Date of Crest	Gage Height	
		Stage feet	Elevation feet
1	October 4, 1898	15(a)	2023
2	June 16, 1949	12.85	2021.24
3	July 1916	12.5(a)	2020.9
4	August 30, 1940	12.5(a)	2020.9
5	March 11, 1952	10.54	2018.93

(a) Estimated from high-water mark.

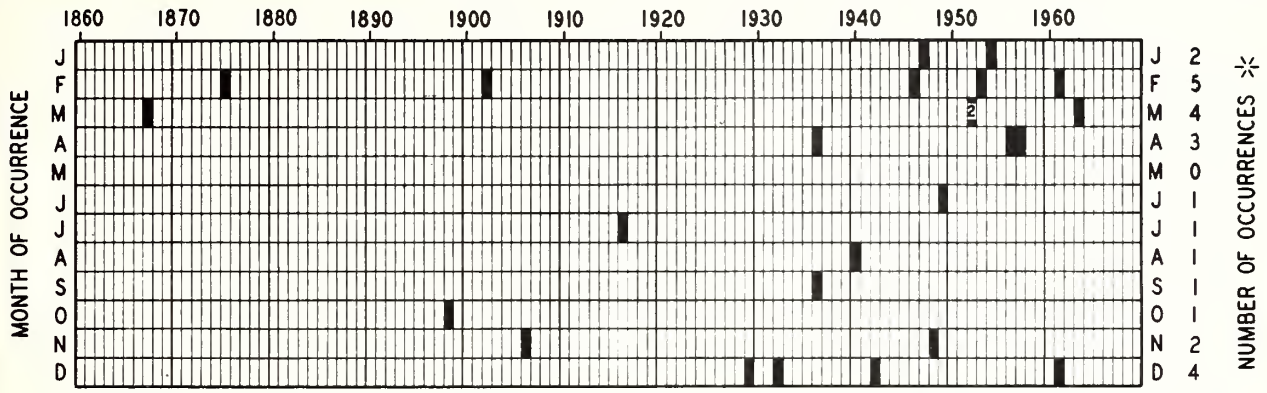
date the flood-crest stages shown are those observed at the Prentiss gage. Stages from 1929 to 1944 are from high-water marks or are estimated from flood stages observed at the Iotla gage by using a stage relationship curve between the two locations. For the period prior to 1929, records of floods are from high-water marks, newspaper accounts, or interviews.

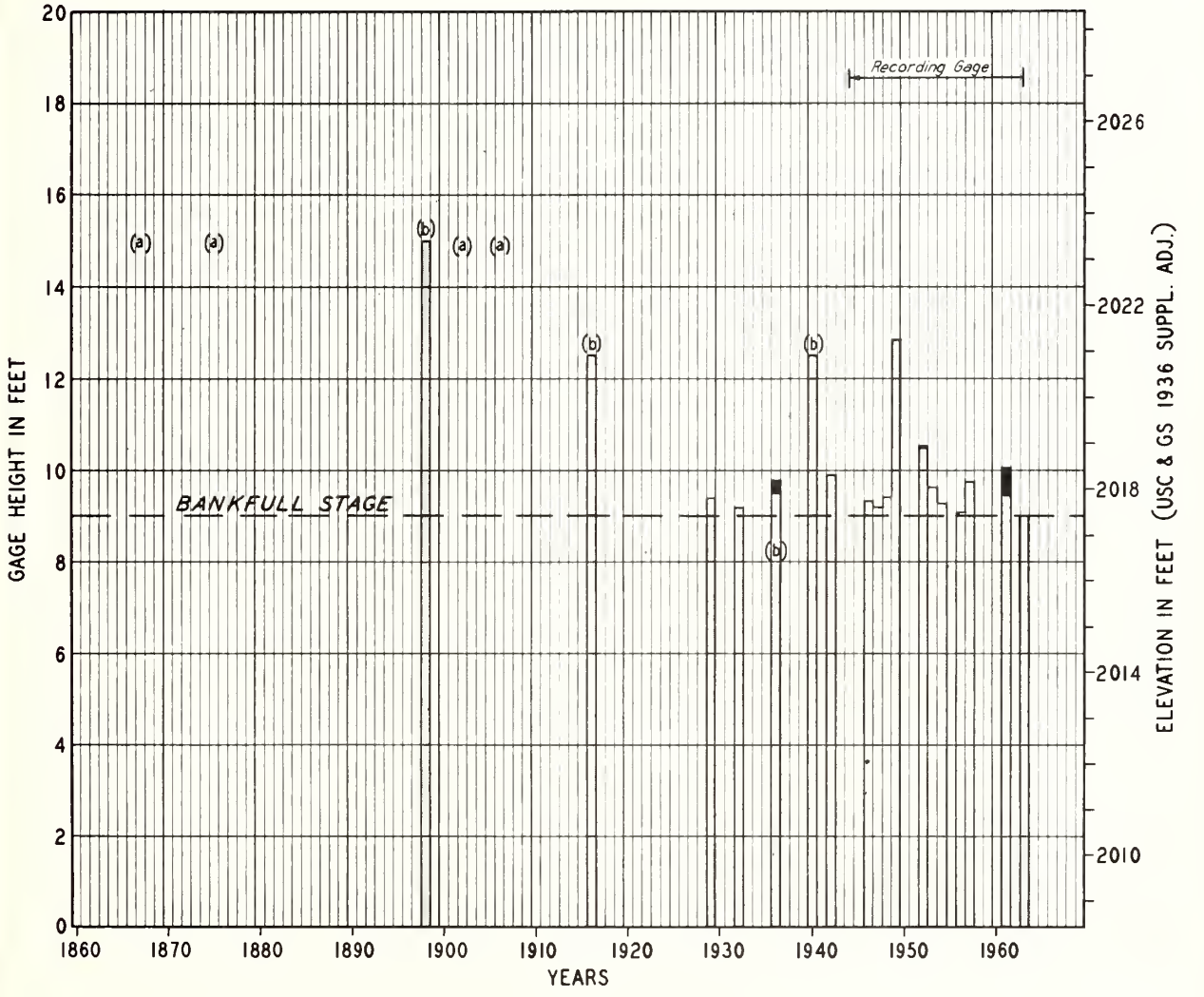
Flood Occurrences

Plate 2 shows crest stages and months of occurrence of known floods which have exceeded the bankfull stage of 9 feet on the Little Tennessee River at the Prentiss stream gage. Table 6 shows the monthly distribution of the 25 known floods occurring since 1867. The record shows that floods have occurred most frequently in the winter and spring months, November through April.

Duration and Rate of Rise

Plate 3 shows the stage hydrograph on Little Tennessee River for the flood of June 16, 1949, at the stream gage near Prentiss. During the 1949 flood, the river rose to its crest stage in 18 hours at an average rate of 0.6 foot per hour with a maximum rate of 1.6 feet per hour, and remained above bankfull





(a) Stage unknown.

(b) Estimated from high water marks.

✳ Number of occurrences during period 1867 through March 1963.

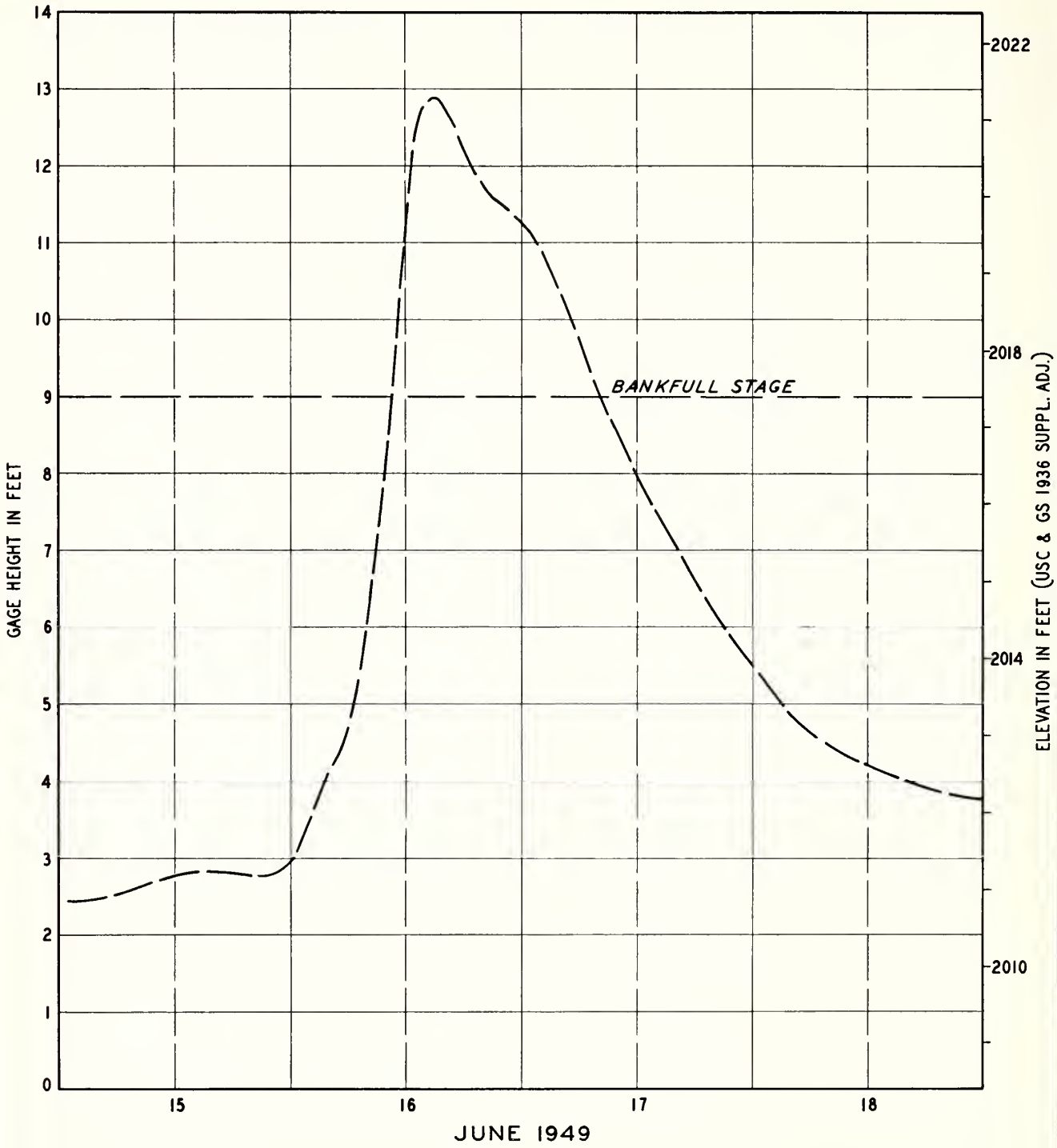
Stream gage located at River Mile 119.47.

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

FLOODS ABOVE BANKFULL STAGE
LITTLE TENNESSEE RIVER NEAR PRENTISS, N.C.

MARCH 1963

PLATE 3



Stream gage near Prentiss
at River Mile 119.47

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

STAGE HYDROGRAPH
LITTLE TENNESSEE RIVER
NEAR PRENTISS, N.C.

MARCH 1963

TABLE 6

MONTHLY FLOOD DISTRIBUTION

LITTLE TENNESSEE RIVER NEAR PRENTISS, N. C.

Month	Number of Occurrences	Month	Number of Occurrences
January	2	July	1
February	5	August	1
March	4	September	1
April	3	October	1
May	0	November	2
June	1	December	4
		Total	25

stage 22 hours. During the August 30, 1940, flood, the average rate of rise was 0.4 foot per hour, the maximum rate 1.1 feet per hour, and duration of flooding 18 hours.

Velocities

During the August 30, 1940, flood, velocities in the channel of Little Tennessee River in the vicinity of Franklin ranged up to 9 feet per second, and overbank velocities ranged up to 3 feet per second. During larger floods, velocities would be even greater.

Flooded Areas, Flood Profiles, and Cross Sections

Plates 7 and 8 show the approximate areas along the Little Tennessee River in the vicinity of Franklin that would be inundated by the flood of August 30, 1940, under present conditions, and by the Maximum Probable Flood. The actual limits of these overflow areas on the ground may vary somewhat from those shown on the maps because the contour interval of the maps does not permit precise plotting of the flooded area boundaries. The contour interval of Plate 7 is 40 feet. The contour interval of Plate 8 is 5 feet.

Plate 9 shows high-water profiles for the floods of August 30, 1940, June 1949, and December 12, 1961. Also shown are the profiles for the Regional and Maximum Probable Floods discussed in Sections III and IV of this report.

Plate 12 shows typical cross sections of Little Tennessee River in the reach investigated. The locations of the sections are shown on the maps and profiles, Plates 7 and 9. The cross sections show the elevation and extent of overflow of the August 30, 1940, flood and the Regional and Maximum Probable Floods.

FLOOD DESCRIPTIONS

Following are descriptions of known floods that have occurred on the Little Tennessee River in the vicinity of Franklin. These are based upon newspaper accounts, historical records, and investigations by TVA engineers.

Early Floods

Information is sparse on the very early floods in the vicinity of Franklin. According to stories told by old settlers, a great flood occurred in the Little Tennessee River basin in May 1840. The flood was apparently most severe on Tuckasegee River, which flows into Fontana Lake on the Little Tennessee River 40 miles below Franklin. Records of this flood in the vicinity of Franklin are sparse.

March 1867

Great floods occurred throughout the upper half of the Tennessee Valley in March 1867. This was the greatest flood ever known on the Little Tennessee River below the Tuckasegee River, as well as on the lower reaches of the Holston and French Broad Rivers and on the Tennessee River from Knoxville through Chattanooga.

February 1875

Interviews with long-time residents indicated that a flood occurred at this time on the extreme lower end of the river. In view of the fact that the

second largest flood of record occurred at Chattanooga on March 1, 1875, and the highest known flood on some streams to the north occurred in 1875, it is probable that a large flood occurred at Franklin.

October 4, 1898

This was the highest known flood upstream from Franklin. Rainfall at Franklin for the two-day period October 3 and 4 amounted to 3.65 inches, but was probably much heavier in the headwaters along the Blue Ridge. Views of this flood are shown in Figure 6, and Figure 7 is a present-day view taken from approximately the same point. The following references to the flood are from the files of the "Franklin Press" from the weekly issues of October 5 and 12, 1898:

> October 5, 1898 - Court was pretty dull Tuesday (October 4), as many who were expected to be here were detained by high waters and could not appear in court.
>
> October 12, 1898 - Mr. Sam Hall says he has marked all the high waters since February 1875, which he says was the highest within his recollection till October 4, 1898, which was 10 inches higher than the freshet of 1875.
>
> Mr. Tom Downs, who lives 6 or 7 miles down the river, reports that the river was 3 feet and 2 inches higher at his place than ever before known since his recollection.
>
> D. A. Jacobs lost 11 fodder stacks and about 500 bushels of corn by the freshet.
>
> The approach to the iron bridge was replaced so vehicles could pass at 10 o'clock Sunday (October 9).

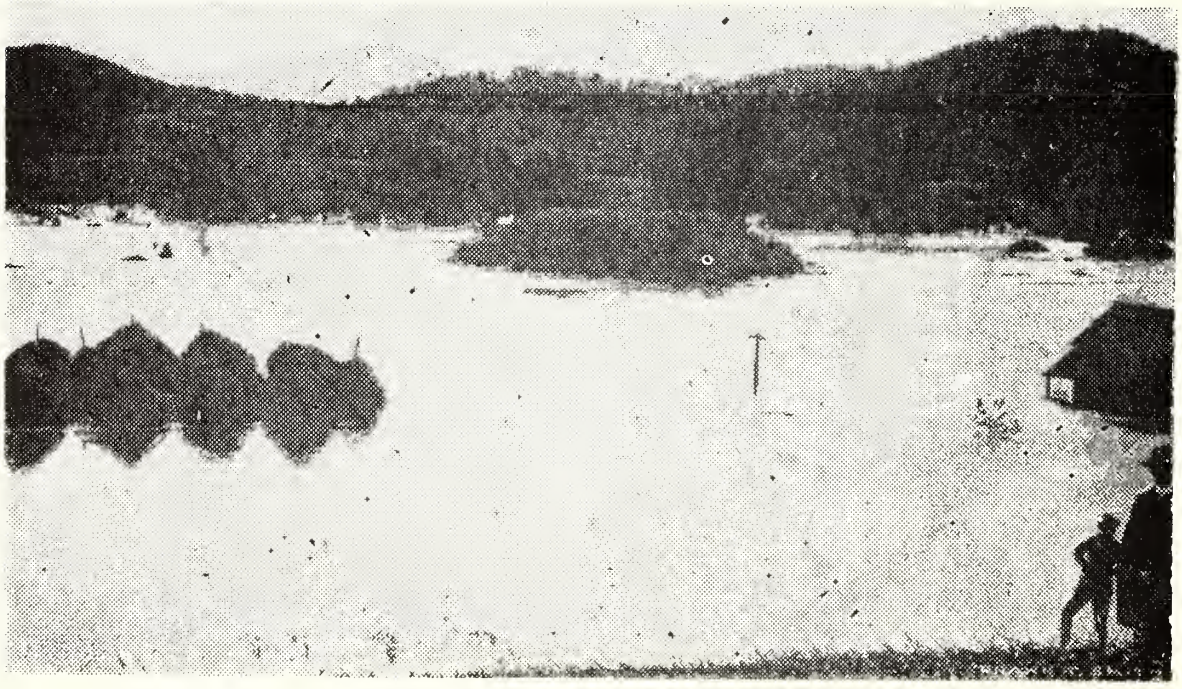
Mr. Sam Hall, mentioned in the above article, was contacted by TVA engineers in 1937, when he was 86 years of age. He was able to point out the mark he had made for the 1898 flood, although the mark had then become quite faint. He could not recall anything definite concerning the earlier floods he observed and had marked at the same point. Two other high-water marks were found to help define this flood height near Franklin.

July 1916

Resulting from intense rains along the Blue Ridge, this was a record flood on the headwaters of the French Broad River, adjoining the Little Tennessee River basin on the east. It was a severe flood on the Cullasaja

'Old Man River' On Rampage

In the pictures above and below, it's the Little Tennessee at Franklin on rampage. Since older people here can first remember, the river has occasionally flooded the lowlands. This photo is of what is said to have been the worst flood in the Little Tennessee's history, in the fall of 1898. (Picture above loaned by Mrs. Belle Liner).



Note the Indian Mound, almost covered, and telephone pole with only a few feet above the water. (Photo loaned by Miss Lassie Kelly).

Figure 6. --LITTLE TENNESSEE RIVER FLOOD OF OCTOBER 4, 1898

These pictures are reproduced from The Franklin Press and The Highlands Maconian of June 16, 1955, and accompanied an editorial entitled "Out of the Past . . . Today". The paper was a centennial edition. A postal card containing the lower view was lent to the TVA by Miss Lassie Kelly of Franklin and bore the title "River Overflow, Looking from East Main Street, Franklin, N. C." The photographer was Frank T. Smith of Franklin.

Figure 7. --VICINITY OF THE INDIAN MOUND, 1963

The picture above was taken from substantially the same point as was the lower view in the old newspaper photographs at left, and shows some of the buildings that would be inundated by a recurrence of the 1898 flood.

River and also quite large on Little Tennessee River below the confluence with Cullasaja River. A high-water mark pointed out near the present U. S. Highway 23, 64, 441 bridge in Franklin showed the flood to be about one foot lower than the 1898 flood.

August 16, 1928

This was a lesser flood on Little Tennessee River, but almost equal to the 1916 flood on the lower reaches of Cullasaja River. The "Franklin Press" of August 23, 1928, states:

HIGH WATERS

> Thursday morning of last week the Little Tennessee at Franklin was out of banks for the first time in twelve years. Reports from various sections of the county indicate that small streams were higher than they had been in a number of years. The high waters were a result of a tropical storm that raged over several south-eastern states. Waters in this county leveled a number of corn fields. In other instances strong winds blew the corn down. The road between Highlands and Dillard became impassable for a day or two due to the fact that some bridges and culverts were washed out. Mr. A. C. Stewart who lives on the Cullasaja stated that the Cullasaja River was higher than he had seen it in 20 years. A few boats docked near Franklin were washed away.

August 1940

Two large floods affected the mountain headwaters of the Tennessee Valley in August 1940. The August 13 flood reached a stage of 15.28 feet at the stream gage on Cullasaja River at Cullasaja, 1.8 feet lower than the 1928 flood crest. A bridge was washed away above Cullasaja, other bridges were damaged, and crops were lost. The rise was less important on Little Tennessee River and damage was of little consequence.

The rainfall of August 29-30 was intense over the headwaters of Little Tennessee River. At Highlands, at the head of Cullasaja River, the total for the storm was nearly 12 inches and at Franklin 8.72 inches were recorded. Floods were much more severe than those experienced on August 13. On the Cullasaja River the flood exceeded any known. At the stream gage at Cullasaja the peak stage was 20.83 feet, 5.5 feet higher than the August 13 flood and 3.6 feet above the 1916 flood. On Little Tennessee River above

Franklin and at the Prentiss gage the flood was 2.5 feet lower than the 1898 flood. At U. S. Highway 23, 64, 441 in Franklin, high-water marks indicate that the 1940 flood was the highest known, being about 5 feet higher than that of 1898. At the Iotla gage, the 1940 flood was about 0.5 foot higher than that of 1898. Roads, bridges, and crops were damaged heavily throughout the basin. At Franklin an oil warehouse, a sawmill, and two stores were flooded. One house was flooded to a depth of 4 feet and six others were surrounded or flooded to a shallow depth.

Less rain fell over the Cartoogechaye Creek basin and the flood was much less severe than on the Cullasaja or Little Tennessee Rivers.

June 16, 1949

An intense storm along the Blue Ridge on June 15 and 16, 1949, produced record or near-record floods on streams in the headwaters of the French Broad, Little Tennessee, and Hiwassee River basins. Over the Little Tennessee River watershed above the mouth of Tuckasegee River, rainfall for the storm averaged 6.4 inches. The rainfall at Franklin was over 7 inches and at Highlands more than 8 inches. The storm was most intense within the 8.4-square-mile watershed of the Coweeta Hydrologic Laboratory, operated by the Southeastern Forest Experiment Station of the U. S. Department of Agriculture, in the headwaters of Little Tennessee River 11 miles south of Franklin. Rainfall exceeded 11 inches for the storm at one of the rain gages in the area and averaged 9 inches for the 62 gages observed in the area.

Intermittent light to heavy showers fell over a four-day period before a general rain began falling about 8 p. m. on June 15. Rain continued until near noon on the following day. By the early morning hours of June 16 small tributaries were out of their banks. By noon three bridges had been washed away by Cullasaja River, and the approaches to the U. S. Highway 23, 64, 441 bridge over Little Tennessee River at Franklin were under water. By the time the river reached its crest at Franklin about 4 p. m. the airport was under water, the airport hangars, two plants, a warehouse, and a house in Franklin were flooded, and 125 cords of pulpwood had been washed away. Figure 8 shows the airport and the wood storage area, and Figure 9 shows the buildings along the main highway about $\frac{1}{4}$ mile west of the river. Bottom

lands throughout the area were flooded and secondary roads were overflowed and damaged by scour. The Little Tennessee River above Franklin was slightly higher than in the flood of August 30, 1940. Through Franklin and downstream to the lower end of the reach, the flood was equal to or slightly lower than the 1940 flood. Cullasaja River in the reach from Cullasaja to the mouth was from less than 1 foot to 3 feet lower than the record 1940 flood.

Cartoogechaye Creek was the highest in the memory of the oldest residents who were interviewed. One steel highway bridge was washed out. Wide overflow occurred along the length of the stream with heavy damage to crops and land.

March 1952

Two floods occurred over the upper Little Tennessee River and its tributaries in March 1952.

The March 11 flood, caused by rainfall averaging 4.4 inches above Franklin for a 14-hour period, was more severe on Little Tennessee and tributaries above Franklin. This flood at the Prentiss stream gage on Little Tennessee River was about 2 feet below the August 30, 1940, stage. On Cullasaja River, the stage at the Cullasaja gage ranked sixth in order of magnitude of known floods. In Franklin the airport was flooded and water was within 2 feet of the road level of the U. S. Highway 23, 64, 441 bridge. Above Franklin, many acres of valuable farm land were covered by several feet of water.

A general rainfall occurred throughout the Little Tennessee River basin during a 39-hour period ending March 23. Heavy runoff resulted throughout the area, particularly along the upper Little Tennessee River. The situation was almost an exact duplicate of the one of 12 days previous when a flood very similar to this one occurred.

At Prentiss along the Little Tennessee River, the crest of this flood was about the same as that of March 11. Along Cullasaja River, stages were lower than those of March 11.

Figure 8. --FRANKLIN AIRPORT FLOODED, JUNE 16, 1949

This view is southeast across the Little Tennessee River near the crest of the flood. A storage yard of logs awaiting shipment to paper mills appears in the foreground between the river and the Tallulah Falls Railroad, now abandoned. The loss of wood amounted to about ten carloads.

(Photo by Crisp Studio, Franklin, N. C.)

Figure 9. --U. S. HIGHWAY 23, 64, 441 UNDER WATER, JUNE 16, 1949

The highway passes across the picture in front of the cars. The Little Tennessee River bridge is out of the view at right, and the river flows into the woods at left center. The house in left center background was the only residence flooded. Picture was made near crest of flood.

(Photo by Crisp Studio, Franklin, N. C.)

December 12, 1961

This was the highest flood in the last 8 or 9 years on the Little Tennessee River in the Franklin vicinity. The flood was lower than the June 1949 flood by about 3 feet over most of the reach on Cullasaja River and by 4 to 5 feet on Cartoogechaye Creek. On Little Tennessee River through Franklin the flood was about 2 feet lower than the 1949 flood. The rather extensive building and filling on the flood plain along U. S. Highway 23, 64, 441 affected the flood height and contributed to the moderate flooding in the vicinity.

March 1963

There were two moderate floods in the Franklin vicinity in March 1963. On Cartoogechaye Creek a flood on March 6 was about one foot lower than the flood of December 12, 1961. Floods on March 12-13 on Little Tennessee and Cullasaja Rivers were also slightly lower than the December 1961 floods on those streams. There was only a small amount of overflow at Franklin, and no damage of consequence occurred.

2. CULLASAJA RIVER VALLEY

The Stream and Its Valley

Cullasaja River drains an area of 93.0 square miles lying wholly within Macon County, North Carolina. The watershed, shown on Plate 1, is generally rectangular, 13 miles long by 7 miles wide. The stream is formed near Highlands, at the crest of the Blue Ridge in a popular summer resort area. Some 14 square miles of area here, lying mostly between 3600 and 4200 feet in elevation, is highly developed with resort enterprises and private homes and cottages. Twelve or more man-made lakes dot the area, the largest two being Mirror Lake and Lake Sequoyah, just outside of Highlands. Cullasaja River proper rises at Cowee Gap, elevation 4200 feet, and flows southwestward parallel to the crest of the Blue Ridge to Highlands. Big Creek lies to the north of Cullasaja River and joins the main stream at Lake Sequoyah. From Lake Sequoyah Cullasaja River drops away sharply from the Blue Ridge through a narrow scenic gorge, falling some 1400 feet in a

reach of about 6 miles. Between the gorge and Franklin the stream has a much more gentle slope and there are relatively broad bottoms in cultivation.

Elevations along the northeast basin boundary, which is the Macon-Jackson county line, are mostly over 4000 feet, with one peak, Yellow Mountain, at elevation 5127 feet. On the opposite side of the basin, at the divide between Cullasaja River and the upper Little Tennessee River, the ridge is generally over 4000 feet elevation where it parallels the gorge section, then drops off to 3000 feet or less. Tributary streams rise at the basin divides and drop steeply to the main stream. The largest of these is Ellijay Creek, which enters at the right bank a short distance upstream from Cullasaja.

Between Cullasaja and the mouth, the reach covered by this investigation, the stream channel falls from 2020 feet to 1998 feet, a slope which averages 5.2 feet per mile. The fall is not uniform, but changes from about 7 feet per mile at the upper end to about 2 feet per mile at the mouth. The flood plain varies in width from 100 feet or less to about 1000 feet. Above Mile 4 the flood plain is generally narrow and brush-covered. Below Mile 4 the valley bottom is mostly 600 to 700 feet in width, with some points near 1000 feet along the lower 3/4 mile of the stream. The bottom lands are well drained throughout the reach. A number of tributaries join Cullasaja River in the reach, but these are small and have no appreciable effect upon flood flows.

The lower 0.24 mile of Cullasaja River is inside the corporate limits of Franklin.

Pertinent drainage areas of the Cullasaja River and its tributaries are given in Table 7.

Developments in the Flood Plain

Plate 10 shows the flood plain of Cullasaja River for the reach investigated. Use of the land in the flood plain is limited almost entirely to agriculture.

U. S. Highway 64 crosses the stream at Cullasaja, Mile 4.16, and follows the right-bank flood plain downstream to Mile 2.9. The road is above known flood heights, except at the bridge and at Mile 3.3. A paved secondary

TABLE 7

DRAINAGE AREAS IN WATERSHED OF CULLASAJA RIVER

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Cullasaja River	Mouth	0	93.0
	At Cullasaja (USGS stream gage), upper limit of study	4.24	86.5
Ellijay Creek	Just above mouth	0.5	20.4

road crosses the stream and flood plain at Mile 1.02. An unpaved road is on or close to the left-bank flood plain through the length of the reach and is subject to overflow at a number of points.

Eight houses, a store, and a service station near the U. S. Highway 64 bridge mark the original site of the community of Cullasaja. The houses are all above known floods. The two commercial developments are now closed and the center of activity for the community is located one-half mile east on high ground in the vicinity of Cullasaja School.

Houses between Cullasaja and Franklin are generally far back from the flood plain and above any of the floods which are known. A house at Mile 3.55 and Wells Grove Church, at Mile 1.03, would probably be affected by a Maximum Probable Flood. Some land in the overflow area is in cultivated crops but most is used for pasture or hay. It is generally well covered throughout the year, giving fair to good protection against the washing and scouring action of flood overflows.

For the small portion of the Cullasaja River flood plain which is within the corporate limits of Franklin, uses made of the land do not differ from those found elsewhere. One farm home on the left bank near the confluence of Cullasaja River with Little Tennessee River is surrounded by water in large floods. Buildings which would be affected by the Maximum Probable and Regional Floods number about 15 and 6, respectively.

TABLE 8

BRIDGES ACROSS CULLASAJA RIVER

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Aug. 30, 1940 Flood Crest Elev. feet	Underclearance Elev. feet	Underclearance Above Aug. 30, 1940 feet	Underclearance Below Aug. 30, 1940 feet
0.23	Footbridge	2000.4	2015.1	(*) 2027.1	2015.2	2014.7		0.5
1.01	County road	2002.2	2021.1	2028.3	2017.6	2019.5	1.9	
3.01	Footbridge	2013.5	2030.0	2040.8	2027.7	2029.8	2.1	
4.16	US Hwy 64	2023.3	2043.1	2050.6	2043.4	2039.8		3.6

(*) Little Tennessee River backwater.

Bridges across the Stream

Two highway bridges and two footbridges cross Cullasaja River in the reach investigated. Table 8 gives pertinent elevations at the bridges and the relation to the crest height for the flood of August 30, 1940. Figure 10 is a photograph of one of the bridges.

U. S. Highway 64, at Mile 4.16, carries traffic between Franklin and the Highlands area. There is only a moderate amount of through traffic on U. S. Highway 64. The route passes through an area of much scenic interest but the heavier east-to-west travel follows other routes which offer better driving conditions. The bridge is a two-span steel truss with wood floor, built in 1924 to replace one which had been at a site just upstream. A short approach fill on the left bank has an average height of about 5 feet. The opening under the bridge has been sufficient to pass all floods except that of August 30, 1940.

The bridge at Mile 1.01 has been built in recent years to provide better access for the residents of the Porter Cove and Clark Chapel sections south of Franklin. This is a single-span steel truss bridge. The main span provides a clear opening of 110 feet, and a right-bank approach span gives an additional opening of 40 feet. Approach fills which cross the left and right bank have a length which totals about 160 feet and heights which range from 7 to 10 feet.

Figure 10. --CULLASAJA RIVER BRIDGE AT MILE 1.01 NEAR FRANKLIN

Figure 11. --BRIDGES OVER CARTOOGECHAYE CREEK

Upper view shows three spans of a 5-span bridge at Mile 1.80 carrying U. S. Highway 23 & 441. Lower view is downstream side of the former U. S. Highway 23 & 441 bridge at Mile 1.95 showing the stream gage shelter.

This has reduced the floodway at the site by a sizable amount, and if the flood of August 30, 1940, or June 1949 were to be repeated under the present conditions water would probably reach or overtop the bridge floor.

Footbridges which are at Mile 0.23 and 3.01 are the suspension type which are commonly built and maintained by the North Carolina State Highway Commission to provide access to homes at points where the cost of a bridge is not justified. The bridge at Mile 0.23 has the ends of the floor span about 8 feet above the top of the stream banks, with steps leading from ground level. Any overbank flow isolates the bridge. The footbridge at the upper site is at a location where the banks are higher and the bridge floor is above the height of past floods.

Obstructions to Flood Flow

Fills on the flood plain at the bridge crossings, as previously described, will serve to restrict flows in very large floods, so that some heading up will occur at these points.

FLOOD SITUATION

Flood Records

Records of river stage and discharge on the Cullasaja River are continuous since 1921. The first observation of river stages was made on June 13, 1907, when a staff gage was installed by the Geological Survey at the highway bridge located about 300 feet upstream from the present U. S. Highway 64 bridge at Cullasaja. This gage was discontinued December 31, 1909. The staff gage was reestablished and records were resumed February 12, 1921. The staff gage was moved to a site just upstream from the bridge July 12, 1921. On May 23, 1934, a recording stream gage went into operation at the site and has operated continuously since that date.

River stage records were begun December 8, 1927, on the Cullasaja River at Highlands, when a recording gage was installed at the spillway of the Lake Sequoyah Dam. Records of stage and discharge began on August 29, 1931, at a recording gage located 0.6 mile below the dam.

To supplement the record from gaging stations, local residents have been interviewed and files of the local newspapers have been searched. TVA engineers were able to obtain detailed information on the flood of December 12, 1961, by observing the crest height in the field. From these records and investigations it has been possible to develop a knowledge of floods on Cullasaja River covering the past 65 years or more.

Flood Stages

Peak stages are given in Table 9 for known floods which have exceeded the bankfull stage of 9 feet at the gage on the Cullasaja River at Cullasaja. For the period 1921 to date, the flood-crest stages shown are those observed at the gage. For floods prior to 1921 flood crest stages shown are from high-water marks or are estimated from newspaper accounts or from interviews with local residents.

Table 10 lists the highest 10 floods in order of magnitude at the Cullasaja stream gage.

Flood Occurrences

Plate 4 shows crest stages and months of occurrences of known floods which have exceeded bankfull stage of 9 feet on the Cullasaja River at the stream gage at Cullasaja. Table 11 shows the monthly distribution of the 43 known floods occurring since 1898. The record shows that floods have occurred most frequently in the period November through April.

Duration and Rate of Rise

Plate 5 shows the stage hydrograph for the flood of August 30, 1940, at the stream gage at Cullasaja. The river rose from a stage of 2 feet on August 29 to a crest of 20.83 feet on August 30 in 19 hours, an average rise of about 1 foot per hour. The maximum rate of rise was 2.9 feet per hour between 9 and 10 p.m. on August 29. The river remained above bankfull stage of 9 feet for a period of 16 to 17 hours.

TABLE 9

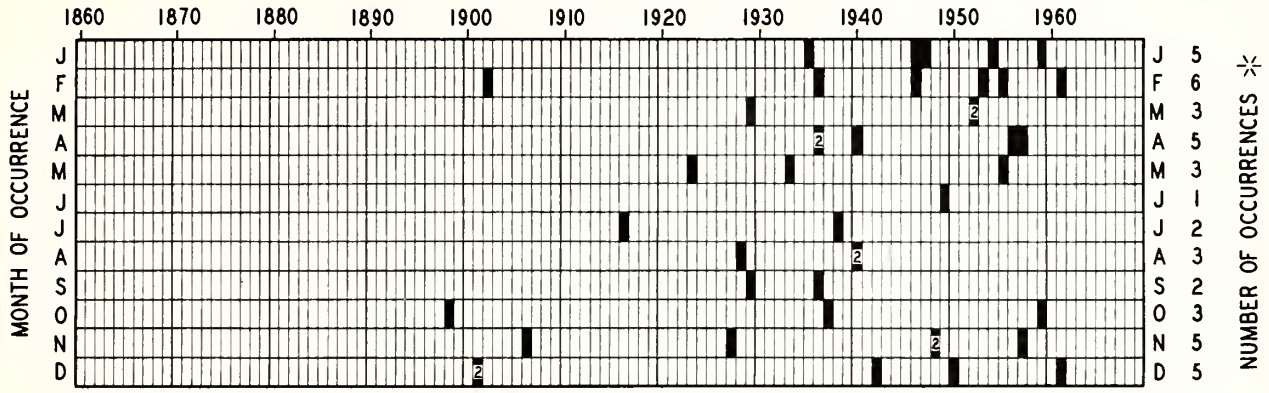
FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE
CULLASAJA RIVER AT CULLASAJA, NORTH CAROLINA
1898-1963

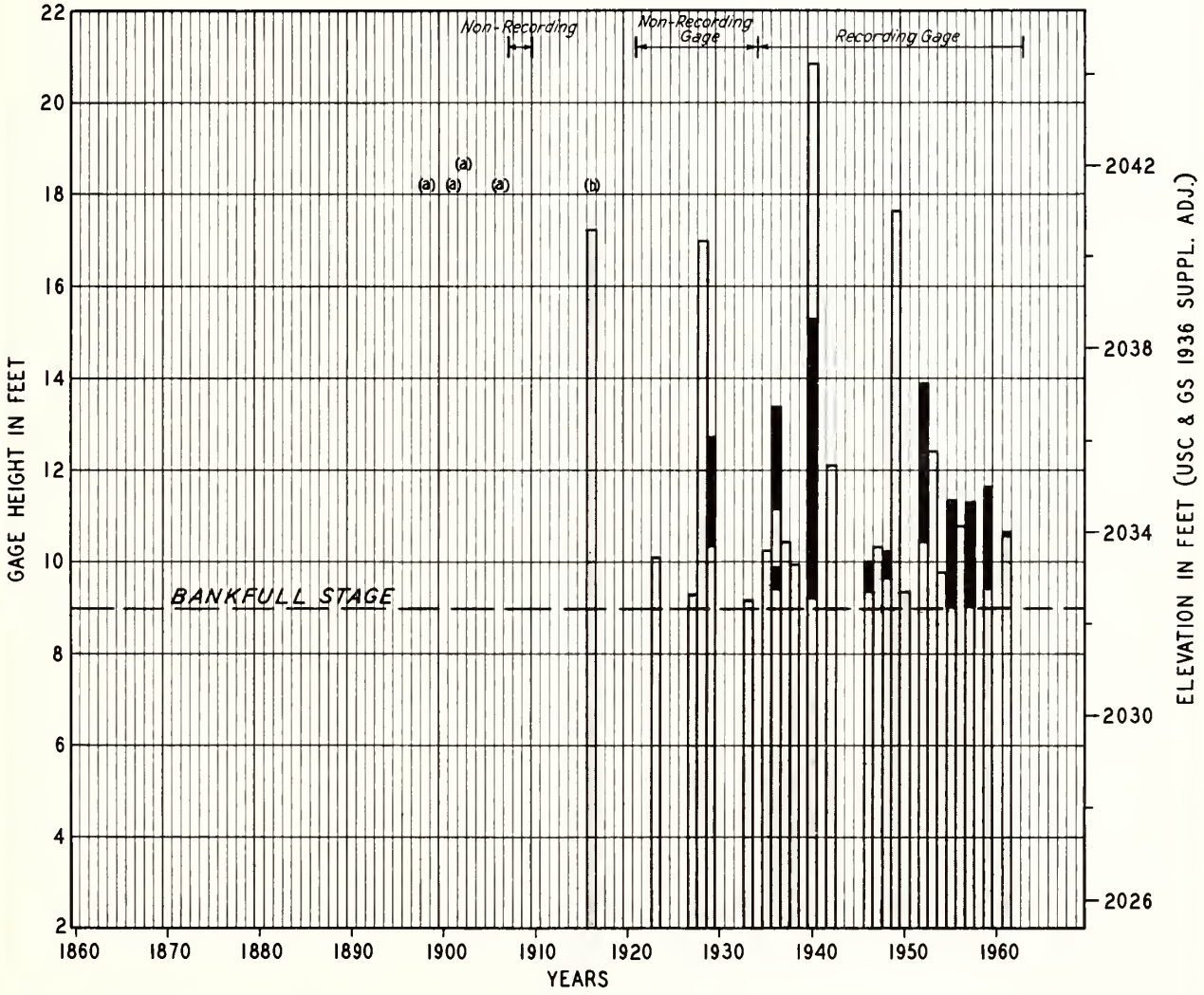
This table includes all known floods above bankfull stage of 9 feet at the U. S. Geological Survey gaging station located 400 feet upstream from the U. S. Highway 64 bridge, Mile 4.24. Drainage area is 86.5 square miles.

Date of Crest	Gage Heights	
	Stage feet	Elevation feet
October 4, 1898	(a)	
December 14, 1901	(a)	
December 28, 1901	(a)	
February 28, 1902	(a)	
November 19, 1906	(a)	
July 1916	17.2[b]	2040.6
May 23, 1923	10.1	2033.5
November 17, 1927	9.30	2032.67
August 15, 1928	17.04	2040.41
March 14, 1929	12.75	2036.12
September 26, 1929	10.35	2033.72
May 5, 1933	9.2	2032.6
January 9, 1935	10.25	2033.62
February 4, 1936	9.40	2032.77
April 2, 1936	9.87	2033.24
April 6, 1936	11.15	2034.52
September 30, 1936	13.40	2036.77
October 19, 1937	10.47	2033.84
July 23, 1938	9.97	2033.34
April 19, 1940	9.21	2032.58
August 13, 1940	15.28	2038.65
August 30, 1940	20.83	2044.20
December 29, 1942	12.10	2035.47
January 7, 1946	9.37	2032.74
February 10, 1946	10.00	2033.37
January 20, 1947	10.35	2033.72
November 6, 1948	9.63	2033.00
November 28, 1948	10.20	2033.57
June 16, 1949	17.60	2040.97
December 7, 1950	9.35	2032.72
March 11, 1952	13.88	2037.25
March 23 1952	10.44	2033.81
February 21, 1953	12.40	2035.77
January 22, 1954	9.78	2033.15
February 6 1955	9.04	2032.41
May 22, 1955	11.33	2034.70
April 15, 1956	10.80	2034.17
April 4, 1957	11.30	2034.67
November 19, 1957	9.01	2032.38
January 21, 1959	11.66	2035.03
October 9, 1959	9.40	2032.77
February 25, 1961	10.61	2033.98
December 12, 1961	10.67	2034.04

(a) Stage unknown.

(b) Estimated from high water marks.





(a) Stage unknown
(b) Estimated from high water marks.

✳ Number of occurrences during period 1898 through March 1963.

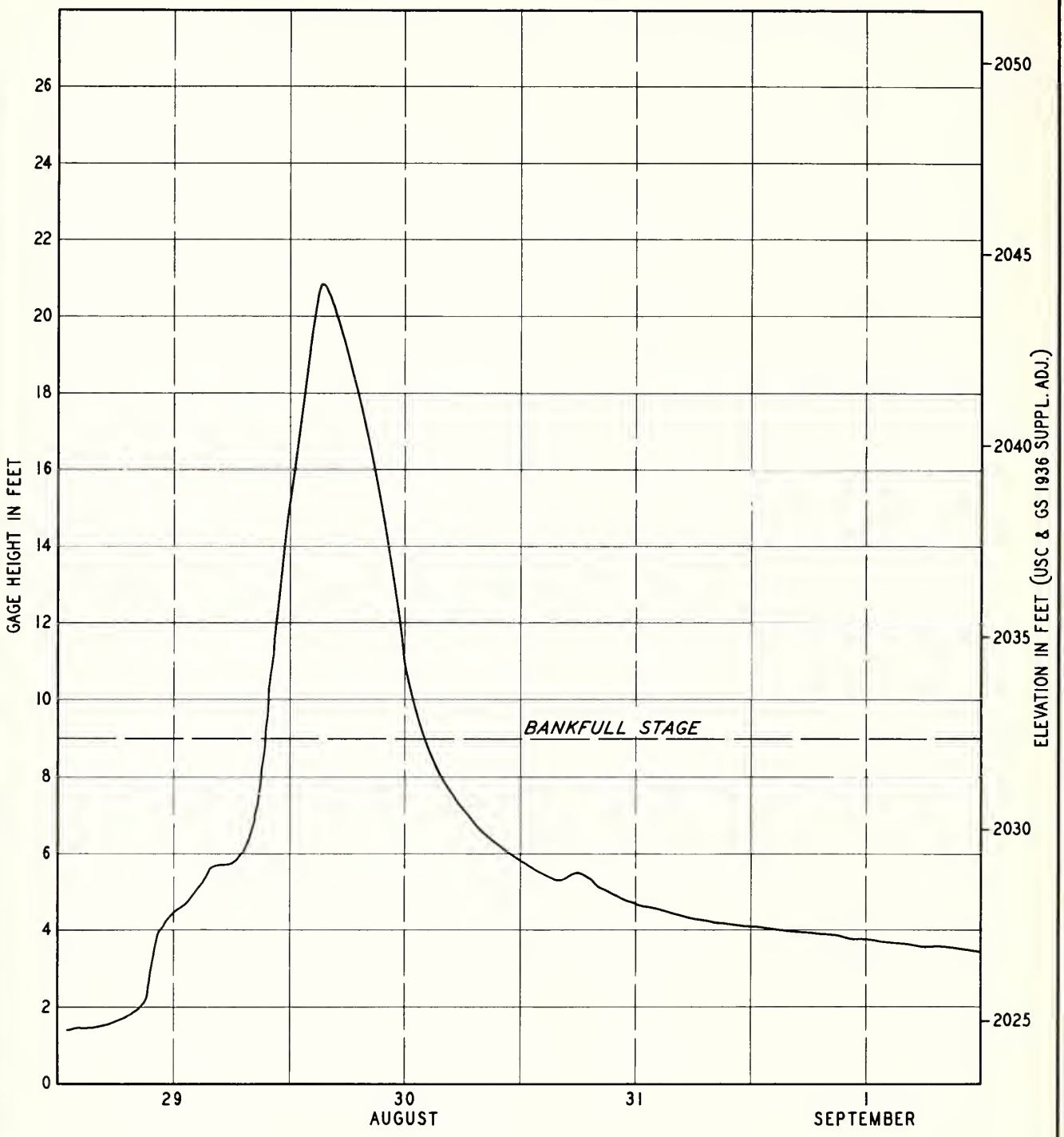
Stream gage located at River Mile 4.24.

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

FLOODS ABOVE BANKFULL STAGE
CULLASAJA RIVER AT CULLASAJA, N. C.

MARCH 1963

PLATE 5



Stream gage located at
River Mile 4.24

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

STAGE HYDROGRAPH
FLOOD OF AUGUST 30, 1940
CULLASAJA RIVER
AT CULLASAJA, N. C.

MARCH 1963

TABLE 10

HIGHEST KNOWN FLOODS IN ORDER OF MAGNITUDE

CULLASAJA RIVER AT CULLASAJA

Order No.	Date of Crest	Gage Height	
		Stage	Elevation
1	August 30, 1940	20.83	2044.20
2	June 16, 1949	17.60	2040.97
3	July 1916	17.2	2040.6
4	August 15, 1928	17.04	2040.41
5	August 13, 1940	15.28	2038.65
6	March 11, 1952	13.88	2037.25
7	September 30, 1936	13.40	2036.77
8	March 14, 1929	12.75	2036.12
9	February 21, 1953	12.40	2035.77
10	December 29, 1942	12.10	2035.47

TABLE 11

MONTHLY FLOOD DISTRIBUTION

CULLASAJA RIVER AT CULLASAJA

Month	Number of Occurrences	Month	Number of Occurrences
January	5	July	2
February	6	August	3
March	3	September	2
April	5	October	3
May	3	November	5
June	1	December	5
		Total	43

Velocities

During the flood of August 30, 1940, velocities in the channel of Cullasaja River in the vicinity of Franklin ranged up to 11 feet per second, and overbank velocities ranged up to 4 feet per second. During larger floods, velocities would be even greater.

Flooded Areas, Flood Profiles, and Cross Sections

Plate 10 shows the approximate area along the Cullasaja River in the vicinity of Franklin that was inundated by the flood of August 30, 1940, and by the Maximum Probable Flood. The actual limits of these overflow areas on the ground may vary somewhat from those shown on the map because the contour interval of the map does not permit precise plotting of the flooded area boundaries. The contour interval of Plate 10 is 40 feet.

Plate 11 shows high-water profiles for the floods of August 30, 1940, June 1949, December 12, 1961, and December 18, 1961. Also shown are the profiles for the Regional and Maximum Probable Floods discussed in Sections III and IV of this report.

Plate 12 shows typical cross sections of Cullasaja River in the reach investigated. The cross sections show the elevation and extent of overflow of the August 30, 1940, flood and the Regional and Maximum Probable Floods.

FLOOD DESCRIPTIONS

Descriptions of the large floods on Cullasaja River are included with the discussion of past floods on Little Tennessee River.

3. CARTOOGECHAYE CREEK VALLEY

The Stream and Its Valley

The drainage area of Cartoogechaye Creek is 58.4 square miles, all lying in Macon County. The basin, shown on Plate 1, is fan-shaped and measures 12 miles in an east-west direction and 9 miles at the widest point in a north-south direction. The headwater drainage system has three principal

streams rising on the slopes of the Nantahala Mountains: Jones Creek and Allison Creek, which join to form Cartoogechaye Creek; and Wayah Creek, which joins Cartoogechaye Creek 6 miles west of Franklin.

Jones Creek rises at the southernmost corner of the watershed against the high ridge which is marked by Foster Knob, Pinnacle Mountain, and Black Mountain, at elevations between 3000 and 5000 feet, and flows northward. Allison Creek has its head at Wallace Gap, elevation 3738 feet, and flows eastward to join Jones Creek at Maidens Chapel. Wayah Creek, the largest of these three streams, rises in a high cove bounded by Wayah Bald, Wayah Gap, and Sheep Knob where elevations range from 4180 to 5340 feet. The stream flows eastward to its confluence with Cartoogechaye Creek at Slagle School. Valley floor elevations in the headwater coves are in the range of 2300 to 2500 feet and near 2100 feet at Slagle School. Below Wayah Creek the basin is only about 4 miles wide, the basin rim is lower, and tributary streams are small and do not appreciably affect flood flows on the main stream.

Between Carson Chapel and the mouth, the reach covered by this investigation, the channel of Cartoogechaye Creek falls from 2051.9 to 2001.8 feet, a slope of 9.3 feet per mile. The fall is quite uniform over the 5.38-mile length. The valley configuration alternates between broad, productive bottom reaches and narrow, steeply wooded sections. The stream channel meanders widely, 5.4 miles of channel being contained in an overall valley length of 3.2 miles.

The stream is in narrow confines from Mile 5.0 to 4.4, from Mile 2.9 to 2.0, and from Mile 1.4 to the mouth. Overbank areas are nonexistent or limited to 100 feet or so in these sections. At the upper limit of the study, Mile 5.4 to 5.0, a broad bottom allows overflow 1000 to 1500 feet wide. A bottom that opens at Mile 4.4 expands to a width of about 1800 feet at Mile 4.0 near the mouth of Blaine Branch, then narrows to 500 feet at Mile 2.9. From Mile 2.9 to Mile 2.0 the overflow widths are between 300 and 600 feet. Near the U. S. Highway 23 and 441 crossing, the flood plain varies from 500 feet to 1500 feet in width between Miles 1.9 and 1.5.

Pertinent drainage areas of Cartoogechaye Creek and its tributaries are listed in Table 12.

TABLE 12

DRAINAGE AREAS IN WATERSHED OF CARTOOGECHAYE CREEK

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Cartoogechaye Creek	Mouth	0	58.4
	Former U. S. Highway 23 & 441 (USGS stream gage)	1.95	57.1
	Upper limit of study (near Carson Chapel)	5.38	47.2

Developments in the Flood Plain

Plate 10 shows the flood plain of Cartoogechaye Creek for the reach investigated. Flood-plain land throughout the reach is used almost exclusively for agriculture.

Since 1956 U. S. Highway 23 & 441 has crossed the stream and flood plain at Mile 1.80. A bridge at Mile 1.95 which previously carried the Federal Highway traffic now handles local traffic only. Secondary roads cross the flood plain at Miles 3.67 and 4.53. The secondary roads which run parallel to the stream are mostly on high ground, far out of flood range. Exceptions are the road on the right bank, Mile 1.95 to Mile 2.3, and one on the left bank from Mile 3.05 to Mile 3.6.

The Franklin Hosiery Company plant on the left bank at the downstream side of U. S. Highway 23 & 441 is now a part of the Burlington Mills organization. The building and parking area are safely above any flood danger.

A recent development on the Cartoogechaye Creek flood plain is the Macon County Fair Grounds, located on the old County Home property on the right bank just downstream from U. S. Highway 23 & 441. Now at this site are an exhibit building, a livestock building, and an exercise ring. The land in the vicinity of the buildings is about elevation 2026 feet. Water was over the site in the flood of June 1949 and would be approximately 29 feet and 19 feet deep here in a Maximum Probable Flood and Regional Flood, respectively.

A baseball field on the right bank just upstream from U. S. Highway 23 & 441 is on ground which is above the height of known floods. A site in this same general area has been proposed for a treatment plant to provide water from Cartoogechaye Creek to meet the increasing demands on the water supply of Franklin.

The remains of Cozads Mill and Dam are located at Mile 2.1, a short distance above the former U. S. Highway 23 & 441 bridge. A 20-foot-high masonry and timber dam was here for many years, but only the abutments and part of the foundations remain now. The mill building on the left bank is now an ice manufacturing and cold storage plant.

Use of the land in the flood plain is principally agricultural. The agricultural land is used mostly for pasture or hay crops. It is well drained and generally well covered throughout the year. Washing and scouring by flood overflows has been minor. In the reach of the investigation on Cartoogechaye Creek, the Maximum Probable and Regional Floods would affect about 18 and 10 buildings, respectively.

Bridges across the Stream

Four highway bridges and two private bridges cross Cartoogechaye Creek in the reach investigated. A bridge which had carried the Tallulah Falls Railroad across the stream at the mouth has now been dismantled. Table 13 gives pertinent elevations at the bridges and the relation to the crest height for the flood of June 16, 1949. Figure 11 on page 39 shows photographs of two of these bridges.

The present U. S. Highway 23 & 441 bridge was built in 1956 as part of a project which widened and straightened the highway south of Franklin. It is a steel-girder, concrete-deck bridge with five spans. Approach fills extend for 200 feet on the left bank and 1400 feet on the right bank and range from 8 to 10 feet in height over most of the length.

Former U. S. Highway 23 & 441 bridge, at Mile 1.95, is a two-span reinforced concrete structure with solid guard rails. Approach fills which cross the narrow flood plain range from 6 to 12 feet in height.

TABLE 13

BRIDGES ACROSS CARTOOGECHAYE CREEK

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	1949 Flood Crest Elev. feet	Underclearance Elev. feet	Above 1949 feet	Below 1949 feet
0.22	Private road	2006.1	2013.1	*2037.5	2021.0	2012.7		8.3
1.80	US Hwy 23 & 441	2016.8	2035.6	2045.3	2032.6	2032.8	0.2	
1.95	Former US Hwy 23 & 441	2018.5	2035.3	2045.9	2033.6	2032.4		1.2
3.67	County road	2036.1	2048.1	2057.9	2049.2	2046.1		3.1
4.53	County road	2043.1	2054.2	2066.8	2060.4	2052.4		8.0
5.38	Private road	2055.5	2063.9	2075.5	2065.6	2063.3		2.3

*Little Tennessee River backwater.

The secondary road bridge at Mile 3.67 is a three-span steel-girder, wood-floor structure. An approach fill on the right-bank flood plain is 500 feet long, averages 5 feet high, and is overflowed at elevation 2046.6 feet. The bridge has been built in recent years to replace a bridge at a site 300 feet downstream.

A single-span steel-girder, wood-floor bridge crosses Cartoogechaye Creek in the narrow reach at Mile 4.53. Considerable heading up occurs in large floods.

Private farm bridges cross the stream near the mouth, at Mile 0.22, and at the upper limit of the study reach, Mile 5.38. Both are of single-span timber construction and are overtopped in all large floods.

Obstructions to Flood Flow

The effects upon flood flows of the bridges and approach fills which are on the flood plain of Cartoogechaye Creek have been previously described. When the present U. S. 23 & 441 bridge was built, the stream channel was straightened to improve flow conditions above and below the bridge. The small amount of the structure which remains at the site of Cozads Mill Dam causes some heading up of flow in moderate rises, but the effect would be negligible in large floods.

FLOOD SITUATION

Flood Records

Records of streamflow on Cartoogechaye Creek are available since June 1961, when the U. S. Geological Survey began operating a recording stream gage at the former U. S. Highway 23 & 441 bridge, Mile 1.95. Some measurements of discharge were made at the site in earlier years, but these were largely limited to periods of low flow and were not useful for flood study purposes.

To supplement the short period of streamflow records, local residents were interviewed and files of local newspapers were searched. TVA engineers obtained information in the field to determine the crest height in detail for the floods of December 12 and 18, 1961.

Flood Occurrences

Because of the meager information on past floods on Cartoogechaye Creek, it was assumed that the distribution of floods would be similar to that on Cullasaja River.

Duration and Rate of Rise

Floods on Cartoogechaye Creek would be about the same duration and would have about the same rate of rise as those on the Cullasaja River.

Velocities

During the June 1949 flood velocities in the channel of Cartoogechaye Creek in the vicinity of Franklin ranged up to 10 feet per second and overbank velocities ranged up to 3 feet per second. During larger floods, velocities would be even greater.

Flooded Areas, Flood Profiles, and Cross Sections

Plate 10 shows the approximate area along Cartoogechaye Creek that would be inundated by the flood of June 1949 and by the Maximum Probable Flood. The actual limits of these overflow areas on the ground may vary somewhat from those shown on the map because the contour interval of the map does

not permit precise plotting of the flooded area boundaries. The contour interval of Plate 10 is 40 feet.

Plate 11 shows high-water profiles for the floods of June 1949, December 12, 1961, and December 18, 1961. Also shown are the profiles for the Regional and Maximum Probable Floods discussed in Sections III and IV of this report.

Plate 12 shows typical cross sections of Cartoogechaye Creek in the reach investigated. The cross sections show the elevation and extent of overflow of the 1949 flood and the Regional and Maximum Probable Floods.

FLOOD DESCRIPTIONS

Descriptions of the large floods on Cartoogechaye Creek are included with the discussion of past floods on Little Tennessee River.

III.

REGIONAL FLOODS

III.

REGIONAL FLOODS[1]

This section of the report relates particularly to floods on streams whose watersheds are comparable with those of the Little Tennessee and Cullasaja Rivers and Cartoogechaye Creek.

Large floods have been experienced in the past on streams in the general geographical and physiographical region of Franklin, North Carolina. Heavy storms similar to those that caused these floods could occur over the watersheds of the upper Little Tennessee River and its tributaries. In this event, floods would result on these streams comparable in magnitude with those that were experienced on neighboring streams. Floods of this size are designated as Regional Floods. It is therefore desirable, in connection with any determination of future floods that may occur on the Little Tennessee and Cullasaja Rivers and Cartoogechaye Creek, to consider floods that have occurred in the region on watersheds whose topography, watershed cover, and physical characteristics are similar to those of these three streams.

Maximum Known Floods in the Region

Table 14 lists the maximum known floods experienced on watersheds comparable with those of the upper Little Tennessee and its tributaries and within about 50 miles of Franklin. Streams which differ significantly in watershed characteristics from those of the upper Little Tennessee and Cullasaja Rivers and Cartoogechaye Creek have not been included. This limits the streams considered to those which have their headwaters in the southern Appalachian Mountains.

One of the earliest documented large storms to occur in the region was that of February 1875. This storm brought very heavy rainfall over the entire eastern Tennessee River watershed resulting in high floods on many streams in the area. The storm, preceded by cold weather, probably fell on frozen ground which contributed to the high runoff. In the vicinity of the Little River watershed which rises in the Great Smoky Mountains, the rainfall totaled

---

1. Prepared by Hydraulic Data Branch.

TABLE 14

MAXIMUM KNOWN FLOOD DISCHARGES ON STREAMS

IN REGION OF FRANKLIN, NORTH CAROLINA

Map Reference No.	Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per Sq. Mi. cfs
1	French Broad River	at Bent Creek, N. C.	676	July 15, 1916	105,000	155
2	Tuckasegee River	at Bryson City, N. C.	655	May 1840	90,000	137
3	Ocoee River	at Emf, Tenn.	524	November 19, 1906	62,000	118
4	Ocoee River	at McHarg, Tenn.	447	November 19, 1906	58,000	130
5	Little Pigeon River	at Sevierville, Tenn.	353	February 25, 1875	55,000	156
6	Tuckasegee River	at Dillsboro, N. C.	347	May 1840	53,000	153
7	Little Tennessee River	at Iotla, N. C.	323	August 30, 1940	19,600	61
8	Little River	nr Maryville, Tenn.	269	February 1875	50,000	186
9	Tuckasegee River	nr East Laport, N. C.	200	August 30, 1940	45,000	225
10	Little River	nr Walland, Tenn.	192	February 1875	40,000	208
11	Tuckasegee River	at Tuckasegee, N. C.	143	August 30, 1940	40,800	285
12	Swannanoa River	at Biltmore, N. C.	130	April 1791	40,000	308
13	Cullasaja River	at Cullasaja, N. C.	86.5	August 30, 1940	16,500*	191
14	E. Fk. Tuckasegee River	nr Tuckasegee, N. C.	80.3	August 30, 1940	30,000	374
15	Cartoogechaye Creek	at former US Hwy 23 & 441 bridge, Franklin, N. C.	57.1	June 16, 1949	7,000	122
16	Deep Creek	at Bryson City, N. C.	43.9	May 1840	20,000	456
17	Caney Fork	ab Cowarts, N. C.	39.4	August 30, 1940	21,700	551
18	Panther Creek	nr Toccoa, Georgia	32.5	June 16, 1949	15,100	465
19	Wolf Creek	nr Tuckasegee, N. C.	14.1	August 30, 1940	14,500	1,030

*See explanation on page 62.

eight or more inches in about two days. The resulting flood was higher than any known by the oldest inhabitants at that time and has not been exceeded since.

A severe storm in November 1906 caused record floods on the Ocoee River. This flood occurred as a result of heavy rains which fell on ground that had been saturated from melted snow. A maximum point rainfall of eight inches in 24 hours was observed at Murphy, North Carolina.

The hurricane of July 1916 caused disastrous floods on many watersheds along the Tennessee Valley Divide, including a record flood on the upper French Broad River and its tributaries, when an estimated maximum of 16 to 18 inches of precipitation fell over the watersheds of some of the tributaries during a two-day period.

The most recent large floods that have occurred in the region were those that accompanied the heavy thunderstorms of late August 1940. About $2\frac{1}{2}$ weeks before this storm, in mid-August, most of the watersheds along the eastern Tennessee Valley Divide from the Blue Ridge Mountains south to the Hiwassee River basin had experienced high floods from a hurricane that brought heavy rainfall to the area. Much of the same area was again deluged by heavy rains on August 29-30. The latter storm lasted but one day, whereas the mid-August storm extended over several days as a result of hurricane activities. The heaviest rainfall occurred over the headwaters of the Tuckasegee and Cullasaja Rivers. Rainfall totaled 10.2 inches on the Tuckasegee River watershed above Tuckasegee, 10.7 inches on the Wolf Creek watershed, 10.0 inches on the Cullasaja River watershed above Cullasaja, and 8.6 inches on the Little Tennessee River watershed above Iotla. Rainfall recorded on August 29-30 totaled 11.65 inches at Highlands and 8.72 inches at Franklin. Record floods occurred on the upper Tuckasegee River and its tributaries and on the Cullasaja River as a result of this storm. At Franklin on the Little Tennessee River, the late August flood was the highest of record.

A recent storm which caused flooding on the upper Little Tennessee River and its tributaries occurred on June 15-16, 1949. Scattered showers and thundershowers had occurred throughout the area for four consecutive days when a general rain began falling about 8:00 p.m. on June 15. Steady rain continued throughout the night and ended about 11:00 a.m. on June 16 at most stations. Storm rainfall averaged 6.35 inches over the Little Tennessee basin

above the mouth of the Tuckasegee River, with a maximum of 11.29 inches recorded by a rain gage at the Coweeta Hydrologic Laboratory. Flooding along Cartoogechaye Creek was the most severe since the large flood of October 1898. At Franklin the Little Tennessee River was almost the same height as the late August 1940 flood, while the Cullasaja River crested about three feet lower than that flood.

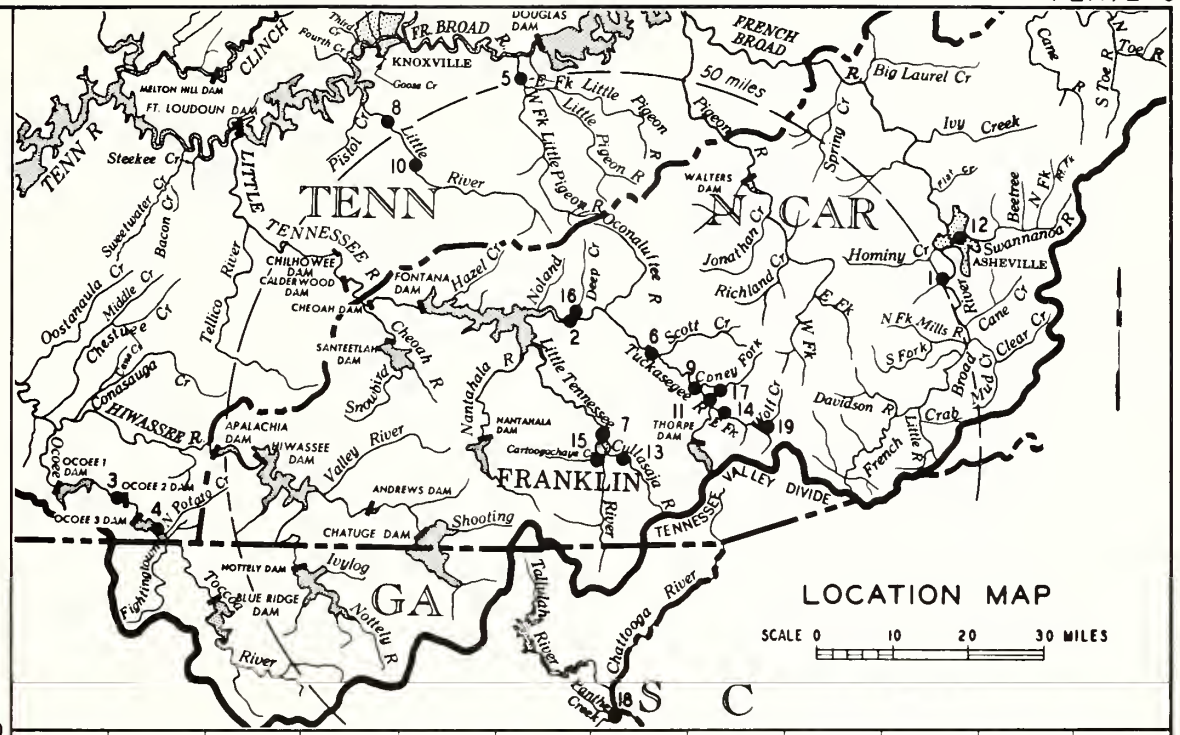
All of the floods listed in Table 14 have occurred on watersheds in the region of Franklin that are similar in physical characteristics. This indicates that floods of like magnitude, modified to take into account differences in drainage area characteristics, could occur in the future on the Little Tennessee and Cullasaja Rivers and Cartoogechaye Creek.

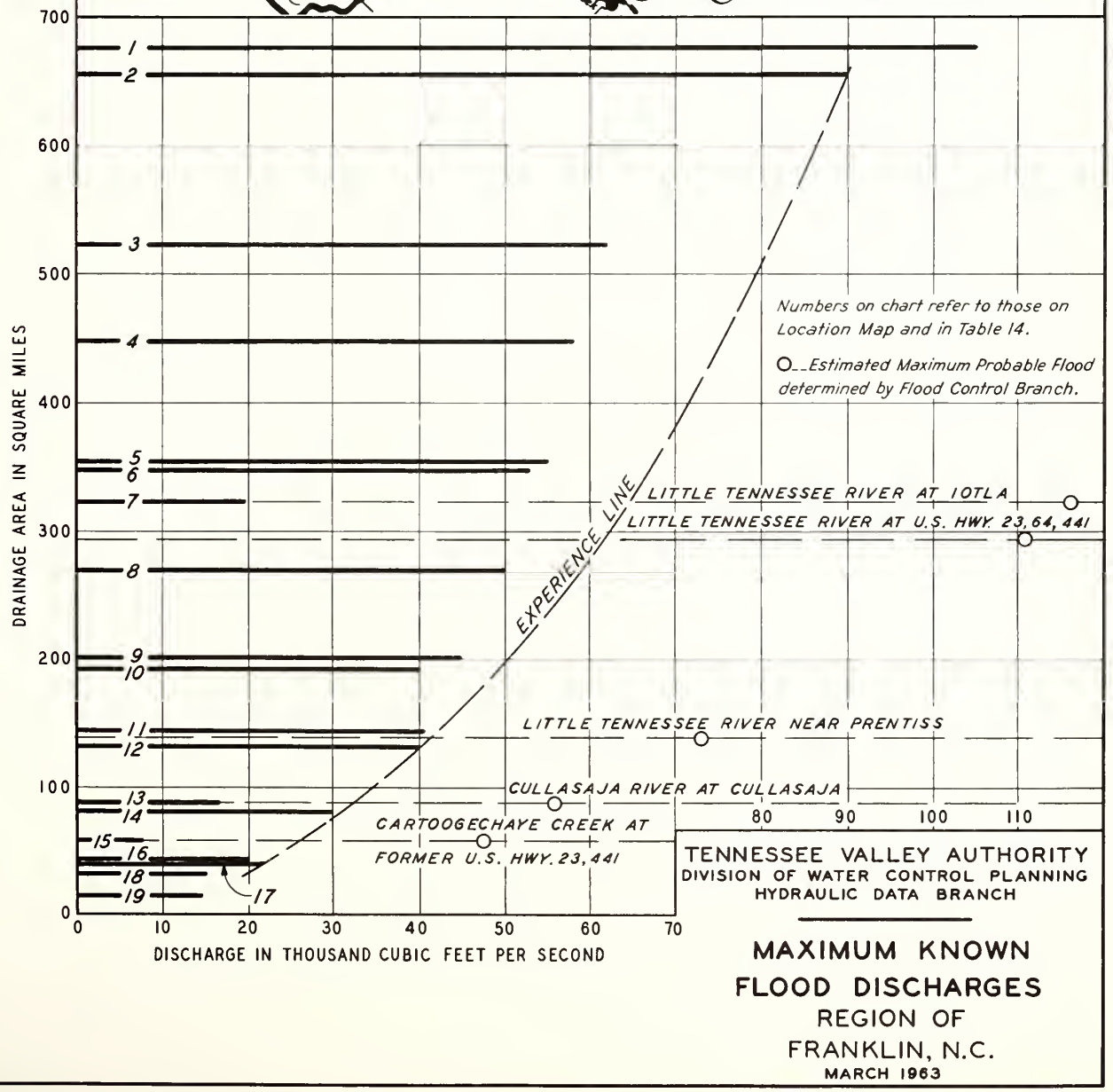
Determination of Regional Floods

Plate 6 is a diagram of the discharges tabulated in Table 14, together with a map showing the locations of the discharge measurements.

Plate 6 shows that the largest floods experienced on streams in the vicinity of Franklin have been exceeded in magnitude by floods on several streams in the region. The tabulation and plate include both summer and winter storms. The summer storms are usually more intense but confined to a smaller area, while the winter storms are usually of longer duration and more general over the region. Two recent examples of summer-type storms were the late August 1940 storm on the Tuckasegee River and the June 1949 storm on the headwaters of the Little Tennessee River. A good example of winter storms which might be expected to occur in the Franklin region was the storm of February 1875 which caused general flooding over a wide area.

A third type of storm which could reasonably be expected to occur over the Franklin region is the hurricane. An example of this is the July 1916 storm, which produced a record flood on the French Broad River. Although the French Broad River lies within the Franklin region, the July 1916 flood was not used in determining a Regional Flood for Franklin. The reason for this lies in the nature of hurricanes and the respective orientation of the French Broad River and the Little Tennessee River. During a hurricane, moist air moving from the Gulf and Atlantic coasts is forced upward by the gradually sloping ground rising to the crest of the Tennessee Valley Divide. As a result,




DRAINAGE AREA IN SQUARE MILES
DISCHARGE IN THOUSAND CUBIC FEET PER SECOND
EXPERIENCE LINE
Numbers on chart refer to those on Location Map and in Table 14.
O--Estimated Maximum Probable Flood determined by Flood Control Branch.
LITTLE TENNESSEE RIVER AT IOTLA
LITTLE TENNESSEE RIVER AT U.S. HWY. 23, 64, 441
LITTLE TENNESSEE RIVER NEAR PRENTISS
CULLASAJA RIVER AT CULLASAJA
CARTOOGECHAYE CREEK AT FORMER U.S. HWY. 23, 441

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

MAXIMUM KNOWN FLOOD DISCHARGES REGION OF FRANKLIN, N.C.

MARCH 1963

the south and east slopes of the Divide and a relatively narrow spill-over area immediately beyond the crest within the Valley are subject to heavy orographic rainfall. Within the Valley this rainfall is generally confined to a relatively narrow band along the top and immediately beyond the Divide. The French Broad River above Bent Creek, because of the nature of the topography, flows parallel to the Blue Ridge Mountains. As a result heavy precipitation occurs over the entire watershed causing unusually high flood discharges. In the Little Tennessee Basin only the headwaters are located in the spill-over area along the Divide and consequently only the upper end of the watershed is subject to heavy flooding. Therefore, floods that result from hurricanes would not be so severe on the Little Tennessee River basin as on the French Broad River basin.

Based upon the maximum flood discharges experienced in the region, it is reasonable to expect future flood discharges on the Little Tennessee and Cullasaja Rivers and Cartoogechaye Creek to be in the order of those given in Table 15. For the purposes of this report, floods of this magnitude are designated as Regional Floods.

A Regional Flood may occur on Little Tennessee River in the reach investigated that would be from about 10 to 19 feet higher than the August 30, 1940, flood but about 11 feet higher in the reach through Franklin. On Cullasaja River a Regional Flood may occur about 8 to 16 feet higher than the August 30, 1940, flood, being about 12 feet higher over most of the reach. A Regional Flood may occur on Cartoogechaye Creek about 7 to 13 feet higher than the June 1949 flood, being about 10 feet higher over most of the reach.

The profile of the Regional Flood on Little Tennessee River is shown on Plate 9. Plate 11 shows the Regional Flood profiles on Cullasaja River and Cartoogechaye Creek. Figures 12 to 18 show the height that would be reached by the Regional Flood at several locations in the vicinity of Franklin.

TABLE 15

REGIONAL FLOOD PEAK DISCHARGES

Stream	Location	Drainage Area sq. mi.	Discharge cfs
Little Tennessee River	U. S. Highway 23, 64, 441 (E. Main Street)	295	62,000
Cullasaja River	at Cullasaja (USGS stream gage)	86.5	33,000
Cartoogechaye Creek	at former U.S. Hwy. 23 & 441 (USGS stream gage)	57.1	26,000

Figure 12. --SUPER MARKET ON RIGHT BANK OF LITTLE TENNESSEE

This building at Mile 116.59, just above the U. S. Highway 23, 64, 441 bridge, is built on filled ground in the flood plain. The floor is 3 feet higher than the flood of August 30, 1940. The Regional and Maximum Probable Floods would reach heights in the store as indicated by arrows on the rod.

Figure 13. --FARM CENTER BUILDING ON U. S. HIGHWAY 23, 64, 441

The building is about 1200 feet from left bank of the river and on the right side of Crawford Branch, a small tributary. The late August 1940 flood came within 0.3 foot of the elevation of the base of the rod. The heights of the Regional and Maximum Probable Floods are shown.

Figure 14. --HANGAR AND OFFICE AT FRANKLIN AIRPORT

This building is about 650 feet from right bank of the Little Tennessee River at Mile 117.00. The flood of August 30, 1940, was 0.4 foot lower than the porch floor level. The Regional and Maximum Probable Flood heights are indicated.

Figure 15. --MOTEL JUST BELOW U. S. HIGHWAY 23, 64, 441 BRIDGE

This motel is built on a fill, which was placed since the 1949 flood, on right bank at Mile 116.53. The 1940 flood level was $5\frac{1}{2}$ feet lower than the base of rod held against the sign. Regional and Maximum Probable Flood heights are shown.

Figure 16. --AUTO SERVICE ESTABLISHMENTS ON U. S. HIGHWAY 23, 64, 441

Upper view is the Phillips 66 gasoline station on the upstream side of the highway at Mile 116.58. Lower view is the Franklin Tire Shop across the road. These are about 200 feet from left bank of the Little Tennessee River. They have both been built since the June 1949 flood and are about 2 feet above both it and the late August 1940 flood. The Regional and Maximum Probable Flood Heights are shown by arrows.

Figure 17. --ZICKGRAF HARDWOOD COMPANY AT MILE 117.15

This dry kiln building between Depot Street and the Little Tennessee River was about 9 feet above the flood of August 30, 1940, but would be flooded by the Regional and Maximum Probable Floods to the heights shown.

Figure 18. --STORAGE BUILDING OF FRANKLIN MINERAL PRODUCTS

Located 700 feet downstream from the building in Figure 17, this building is on ground that was about 6 feet higher than the late August 1940 flood. Heights of the Regional and Maximum Probable Floods are shown by arrows.

IV.

MAXIMUM PROBABLE FLOODS

IV.

MAXIMUM PROBABLE FLOODS[1]

This section discusses the Maximum Probable Floods on the Little Tennessee River, Cullasaja River, and Cartoogechaye Creek in the vicinity of Franklin, North Carolina, and some of the hazards of great floods. Floods of the magnitude of the Maximum Probable Floods are the kind considered in planning construction and operation of protective works, the failure of which might be disastrous. They represent reasonable upper limits of expected flooding.

Drainage areas at the upper and lower limits, respectively, of the study are 140 and 323 square miles on the Little Tennessee River, 86.5 and 93.0 square miles on the Cullasaja River, and 47.2 and 58.4 square miles on Cartoogechaye Creek.

Extreme floods on these streams are most likely to result from either of two types of storms--intense periods of rainfall during winter storms of fairly long duration, or short-duration storms of the cloudburst or hurricane type usually occurring during summer. Infiltration and other losses are generally low in winter and generally high in summer.

DETERMINATION OF MAXIMUM PROBABLE FLOODS

In determining the Maximum Probable Floods on the Little Tennessee River, Cullasaja River, and Cartoogechaye Creek in the vicinity of Franklin, consideration was given to great storms and floods that have already occurred on these watersheds and to those which have occurred elsewhere but could have occurred in this area. This procedure provides information about possible floods and storms additional to that which can be gained from the short-term local hydrologic records alone.

The maximum known flood on the Little Tennessee River at the Prentiss gage occurred in 1898, with a peak discharge of 9,000 cubic feet per

---

1. Prepared by Flood Control Branch

second. At Franklin and downstream to Iotla, the maximum known flood occurred on August 30, 1940, with discharges estimated to have been 18,000 and 19,600 cubic feet per second, respectively.

On the Cullasaja River in the vicinity of Franklin the maximum known flood occurred on August 30, 1940. Peak discharge published for the USGS stream gage is 16,500 cubic feet per second as estimated by tangential extension of the rating curve. Unit hydrograph and backwater studies made for this report, however, indicate that the peak flow might have been lower, about 13,000 cubic feet per second.

On Cartoogechaye Creek in the vicinity of Franklin the maximum known flood occurred on June 16, 1949. The peak discharge near the mouth is estimated to have been 7,000 cubic feet per second.

It is reasonable to expect that greater floods will occur on these streams.

Observed Storms

Observed storms are meteorologically transposable to the Franklin area from within a broad region extending generally from the Atlantic Ocean to the Appalachian Divide and From Florida through Pennsylvania. The moisture source for storms in this region is the warm, moist air flowing northward from the tropical Atlantic Ocean. In general, the moisture potential for a given region decreases with its increased distance from the moisture source. Transposition of storms from within the broad region includes adjustments for the particular meteorological conditions to be expected at Franklin. Table 16 lists known rainfall depths for several large storms transposable to this area.

TABLE 16

SELECTED MAXIMUM OBSERVED STORMS TRANSPOSABLE

TO THE REGION OF FRANKLIN, NORTH CAROLINA

Date	Location	Area	Rainfall	
			Duration	Depth
		sq. mi.	hours	inches
August 1939	New Jersey	60	6	9.4
		90	8	11.8
		320	8	10.7
September 1940	New Jersey	60	6	18.3
		90	8	18.8
		320	8	14.4
October 1941	Florida	60	6	11.1
		90	8	14.7
		320	8	12.0

Upon the basis of these and other data, as adjusted for conditions at Franklin, the following rainstorms were adopted for computing the Maximum Probable Floods.

Location	Drainage Area	Rainfall	
		Duration	Depth
	sq. mi.	hours	inches
Little Tennessee River			
Upper limit	140	8	16.1
Former Iotla gage	323	8	14.4
Cullasaja River			
Gage	86.5	8	17.1
Cartoogechaye Creek			
Upper limit	47.2	6	17.5
Lower limit	58.4	6	17.0

From a meteorological standpoint, storms as much as 40 percent greater than these can occur.

Observed Floods

Factors such as the meteorology of the region and flood-producing characteristics of the watershed were given consideration in determining whether

TABLE 17

SELECTED MAXIMUM OBSERVED FLOODS

Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per Sq. Mi. cfs
N. F. Catawba R.	Woodlawn, N. C.	41.8	1940	55,000	1,320
Elk River	Elk Park, N. C.	42.0	1940	27,500	655
Linville River	Branch, N. C.	65.0	1940	39,500	608
Wilson Creek	Adako, N. C.	66.0	1940	99,000	1,500
Warrior Fork	Morganton, N. C.	80.5	1940	38,000	472
Watauga River	Sugar Grove, N. C.	90.8	1940	50,800	559
Mud Creek	Naples, N. C.	109	1916	40,000	367
Catawba River	Marion, N. C.	170	1940	71,000	418
N. F. New River	Crumpler, N. C.	277	1940	79,400	287
Catawba River	Bridgewater, N. C.	380	1940	141,760	373
Yadkin River	Wilkesboro, N. C.	493	1940	160,000	325
L. Tennessee R.	Iotla, N. C.	323	1940	19,600	60.7
L. Tennessee R.	US Hwy 23, 64, 441 at Franklin, N. C.	295	1940	18,000	61.0
L. Tennessee R.	Prentiss, N. C.	140	1898	9,000	64.3
Cullasaja River	Cullasaja, N. C.	86.5	1940	16,500*	191
Cartoogechaye Cr.	Former US Hwy 23 & 441 at Franklin, N. C.	57.1	1949	7,000	123

*See explanation on page 62.

peak discharges on other streams are applicable. Tables 14 and 17 list peak discharges for observed floods on several streams of approximately the size of those discussed in this report. For comparison the discharge of the maximum known flood on each stream included in this study is listed in Table 17.

Maximum Probable Flood Discharges

From consideration of the flood discharges in Table 17 and of the transposition to the Franklin area of outstanding storms, the peak discharge of the Maximum Probable Flood at selected locations was determined to be as follows:

Stream	Location	Drainage Area sq. mi.	Peak Discharge cfs
Little Tennessee River	Former USGS stream gage at Iotla	323	116,000
	U. S. Highway 23, 64, 441 (E. Main Street)	295	111,000
	Upper limit of study (Prentiss stream gage)	140	73,000
Cullasaja River	at Cullasaja (USGS stream gage, upper limit of study)	86.5	56,000
Cartoogechaye Creek	Mouth	58.4	49,000
	Former U. S. Highway 23 & 441 (USGS stream gage)	57.1	48,000
	Upper limit of study (near Carson Chapel)	47.2	42,000

Frequency

It is not possible to assign a probability of occurrence or frequency to the Maximum Probable Flood. The occurrence of such a flood would be a rare event; however, it could occur in any year.

Possible Larger Floods

Floods larger than the Maximum Probable are hydrologically possible; however, the combination of factors that would be necessary to produce such floods would seldom occur. The consideration of floods of this magnitude is of greater importance in some problems than in others but should not be overlooked in the study of any problem.

HAZARDS OF GREAT FLOODS

The amount and extent of damage caused by any flood depend in general upon how much area is flooded, the height of flooding, the velocity of flow, and the rate of rise.

Areas and Heights of Flooding

The areas flooded by the Maximum Probable and maximum known floods are shown on Plates 7, 8, and 10. Depths of flow can be estimated from the crest profiles which are shown on Plates 9 and 11.

Profiles were computed by using stream characteristics for selected reaches as determined from observed flood profiles, topographic maps, and cross sections which were surveyed in 1962. The elevations shown on Plates 9 and 11 and the overflow areas shown on Plates 7, 8, and 10 have been determined with an accuracy consistent with the purposes of this study and the accuracy of the basic data. More precision would require costly surveys not warranted by this study.

The profiles of the Maximum Probable Floods depend in part upon the degree of destruction or clogging of various bridges during the floods. Because it is impossible to forecast these events, it was assumed that all structures would stand and that no clogging would occur.

The Maximum Probable Flood profile on the Little Tennessee River is from 17 to 29 feet higher than elevations experienced in the August 30, 1940, flood, and about 21 feet higher over most of the reach. The maximum difference occurs at the stream gage near Prentiss, Mile 119.47. On the Cullasaja River the Maximum Probable Flood profile is from 13 to 22 feet higher than elevations experienced on August 30, 1940, and about 18 feet higher over most of the reach. The maximum difference occurs at Mile 2.3 and is partially the result of heading-up at a constricted section at Mile 2.06. The Maximum Probable Flood profile on Cartoogechaye Creek is from 11 to 22 feet higher than the June 16, 1949, flood and about 20 feet higher over most of the reach. The maximum difference occurs in the vicinity of the new U. S. Highway 23 & 441 bridge, Mile 1.80.

Figures 12 to 18 on pages 57 to 60 show the height that would be reached by the Maximum Probable Flood at several locations in the vicinity of Franklin.

Velocities and Rates of Rise

Water velocities during the Maximum Probable Flood depend largely upon the size and shape of the cross section, the condition of the stream, and

the bed slope, all of which vary on different streams and at different locations on the same stream.

During the Maximum Probable Flood, velocities in the main channel of the Little Tennessee River, Cullasaja River, and Cartoogechaye Creek would range up to 22, 16, and 26 feet per second, respectively. In the overflow areas, velocities would range from less than 1 to about 6 feet per second, from 2 to about 8 feet per second, and from 1 to about 6 feet per second on the Little Tennessee River, Cullasaja River, and Cartoogechaye Creek, respectively.

The Maximum Probable Flood on the Little Tennessee River at the U. S. Highway 23, 64, 441 bridge, Mile 116.55, would rise about 32 feet above low water to its crest stage in about 16 hours with a maximum rate of rise of 4 feet in 1 hour. Its duration is estimated to be about 2 days.

On the Cullasaja River at the gaging station, Mile 4.24, the rise would be about 34 feet above low water to its crest stage in about 12 hours with a maximum rate of rise of 6 feet in 1 hour. Its duration is estimated to be about $1\frac{1}{2}$ to 2 days.

On Cartoogechaye Creek on the downstream side of former U. S. Highway 23 & 441 bridge at Mile 1.95, the rise would be about 36 feet above low water to its crest stage in about 10 hours with a maximum rate of rise of 5 feet in 1 hour. Its duration would be 1 to $1\frac{1}{2}$ days.

These rapid rates of rise and high stream velocities in combination with deep flooding would create a hazardous situation in developed areas.

TENNESSEE VALLEY AUTHORITY
KNOXVILLE, TENNESSEE 37902

13 October 1965

TO: Mr. William S. Powell

Reference is made to the report, FLOODS ON LITTLE TENNESSEE RIVER, CULLASAJA RIVER, AND CARTOOGECHAYE CREEK IN VICINITY OF FRANKLIN, NORTH CAROLINA, dated March 1963, copies of which were sent to your office.

The flood of October 1964 was much greater than any former floods in the Franklin region for which discharges have been measured. The new information about the behavior of the Little Tennessee River at Franklin prompted a restudy of the future floods that may be expected on this stream. The profiles of the Regional and Maximum Probable Floods have been reviewed and their accuracy improved. Profiles of the 1964 flood on the Little Tennessee and Cullasaja Rivers and on Cartoogechaye Creek have also been added to the High Water Profiles plates. In addition, the flooded area maps, Plates 7 and 10, have been revised to show the 1964 flood.

Prints of the revised Plates 7, 9, 10, and 11 for the streams mentioned above are sent you herewith. It is suggested that corresponding plates in your report dated 1963 be marked superseded and that the enclosed revisions dated 1965 be inserted in their place.

A two-color brochure presenting a brief picture of the flood situation at Franklin is also enclosed. This brochure has been given wide distribution by the Franklin Board of Aldermen.

Sincerely,

James E. Goddard

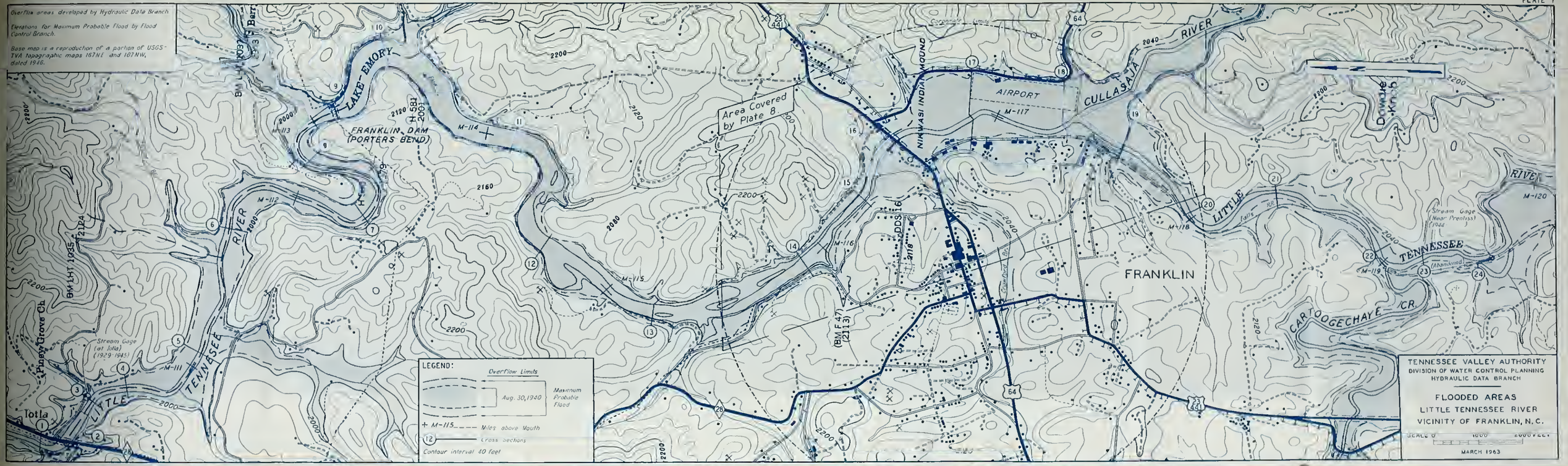
James E. Goddard
Chief of Local Flood Relations

Copies: To each recipient of the original report
Enclosures

Overflow areas developed by Hydraulic Data Branch.

Elevations for Maximum Probable Flood by Flood Control Branch.

Base map is a reproduction of a portion of USGS-TVA topographic maps 167NE and 167NW, dated 1946.



LEGEND:

Overflow Limits

Aug. 30, 1940

Maximum Probable Flood

+ M-115 ---- Miles above Mouth

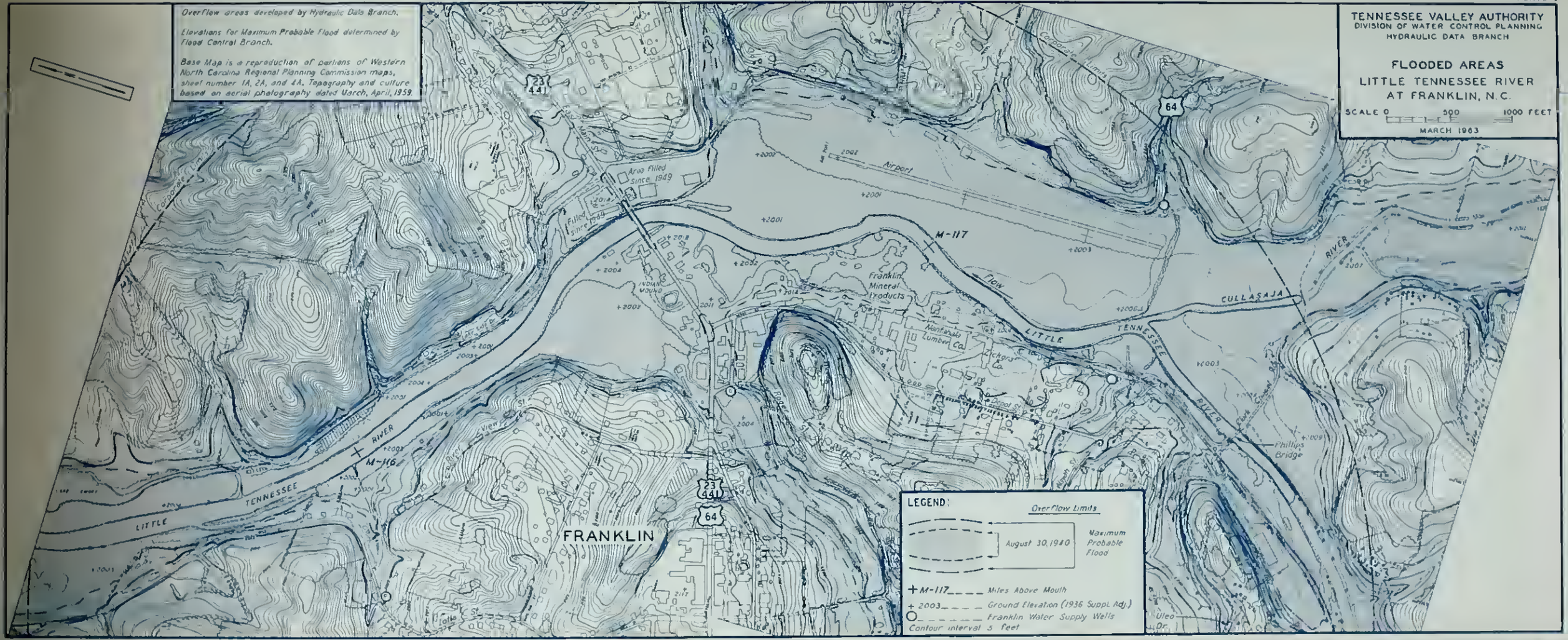
12 —— Cross Sections

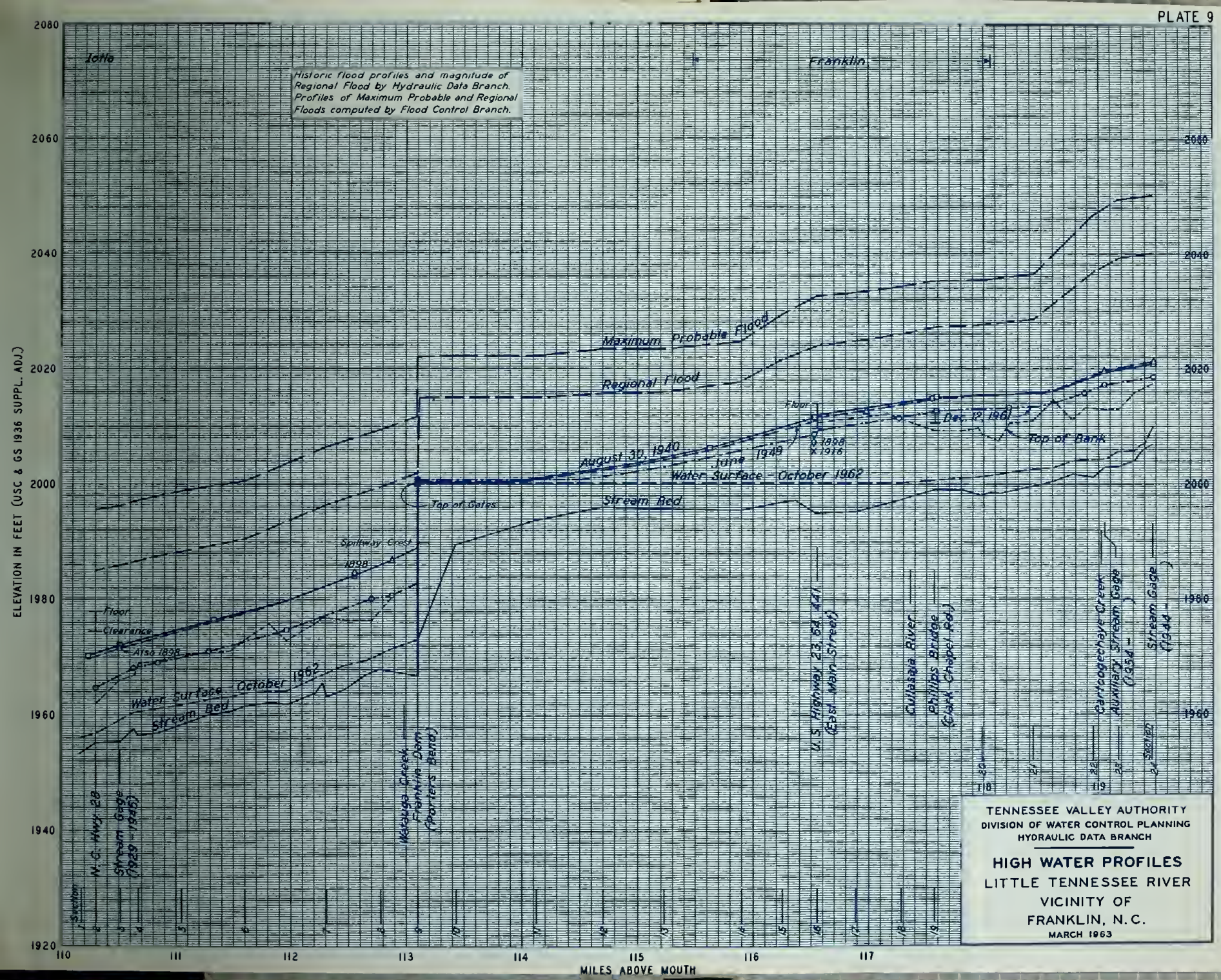
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

FLOODED AREAS
LITTLE TENNESSEE RIVER
VICINITY OF FRANKLIN, N. C.

SCALE 0 1000 2000 FEET

MARCH 1963

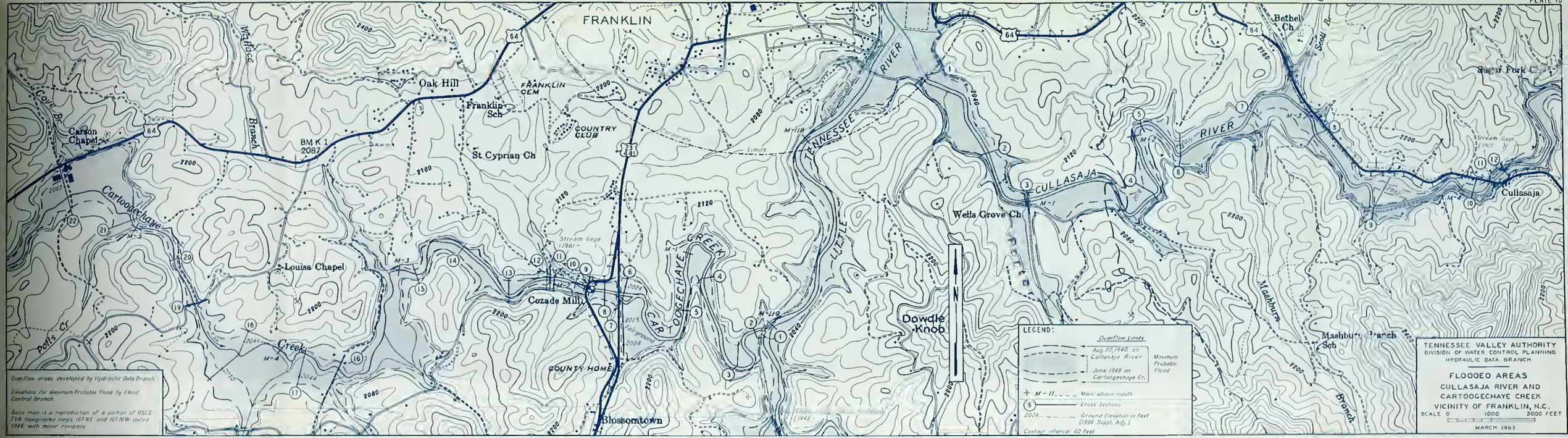

Overflow areas developed by Hydraulic Data Branch.
Elevations for Maximum Probable Flood determined by Flood Control Branch.
Base Map is a reproduction of portions of Western North Carolina Regional Planning Commission maps, sheet number 1A, 2A, and 4A. Topography and culture based on aerial photography dated March, April, 1959.
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH
FLOODED AREAS
LITTLE TENNESSEE RIVER
AT FRANKLIN, N.C.
SCALE 0 500 1000 FEET
MARCH 1963
Corporate Limits
Main St.
Area filled since 1949
Filled since 1949
Airport
M-117
Flow
Franklin Mineral Products
Manhattan Lumber Co.
Dicks Creek
Ridge
Indian Mound
CULLASAJA
RIVER
LITTLE TENNESSEE RIVER
Phillips Bridge
Ulco Dr.
M-116
Cobbett
Scenic View
Rabbit Creek
Tellico St.
FRANKLIN
23 441
64
LEGEND
Overflow Limits
August 30, 1940
Maximum Probable Flood
+M-117 Miles Above Mouth
+2003 Ground Elevation (1936 Suppl. Adj.)
Franklin Water Supply Wells
Contour interval 5 feet

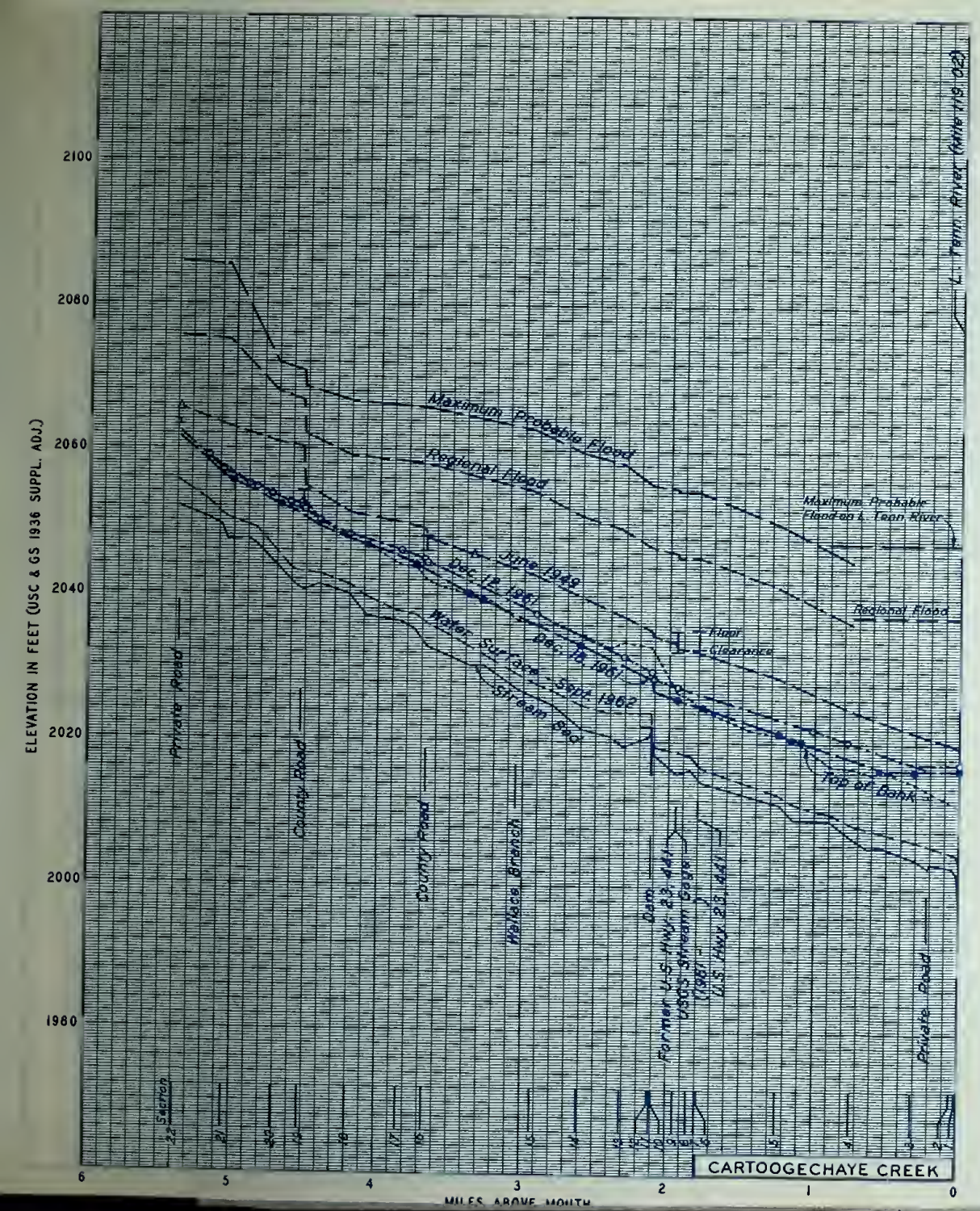


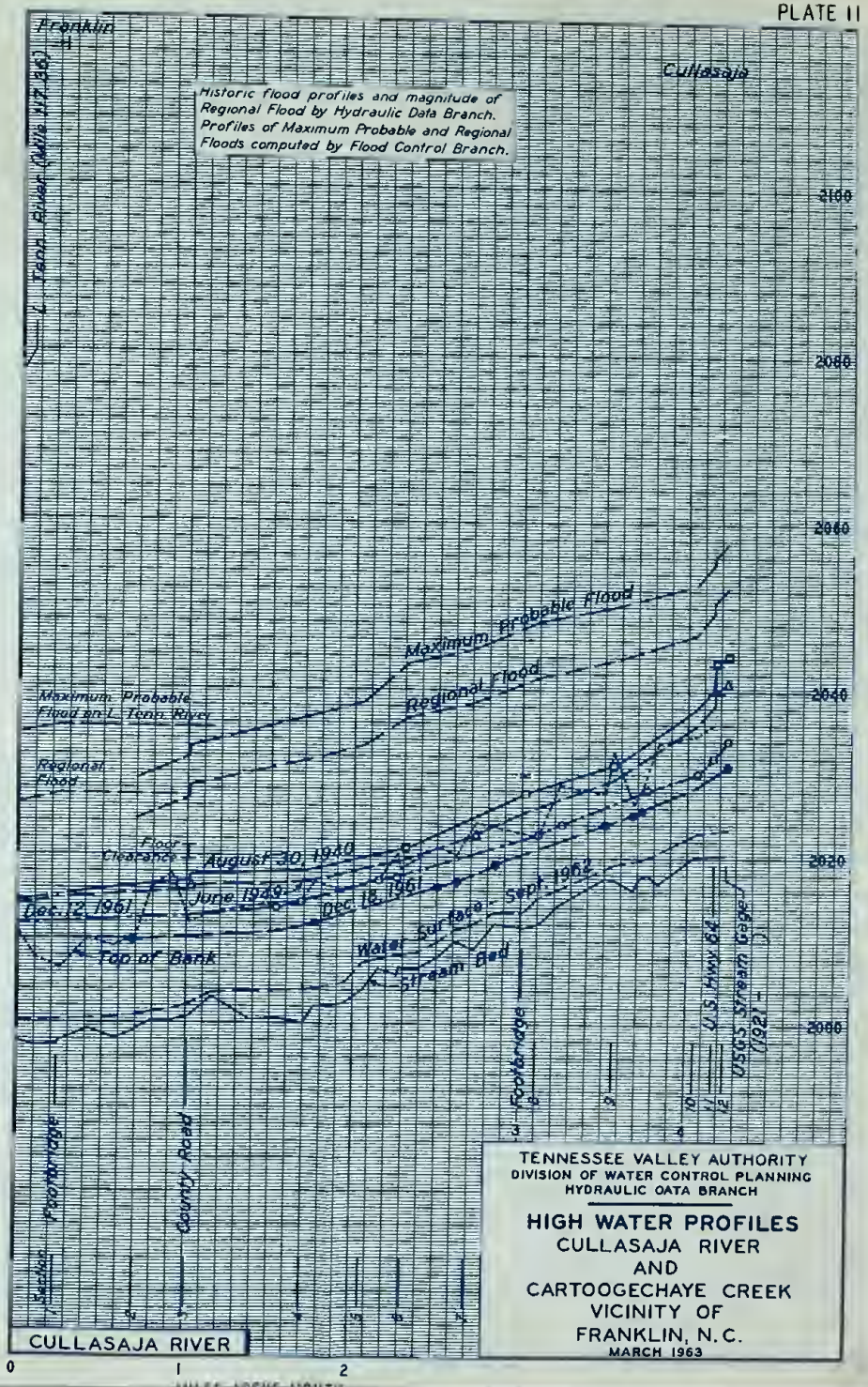
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

HIGH WATER PROFILES
LITTLE TENNESSEE RIVER
VICINITY OF
FRANKLIN, N.C.

MARCH 1963


FRANKLIN
Oak Hill
Franklin Sch
FRANKLIN CEM
COUNTRY CLUB
St Cyprian Ch
BM K 1 2087
Carson Chapel
Cove Br
Wallace Branch
Cartoogechaye Creek
Louisa Chapel
Ports Cr
Cozads Mill
COUNTY HOME
Blossomtown
CARTOOGECHAYE CREEK
Little Falls Rd
TENNESSEE RIVER
Wells Grove Ch
Dowdle Knob
CULLASAJA RIVER
Bethel Ch
Scott Br
Cullasaja
Mashburn Branch
Mashburn Sch
Stream Gage (1961-)
Fairground
Limits
Corporate
Overflow areas developed by Hydraulic Data Branch.
Elevations for Maximum Probable Flood by Flood Control Branch.
Base map is a reproduction of a portion of USGS-TVA topographic maps 167 NE and 167 NW dated 1946 with minor revisions
LEGEND:
Overflow Limits
Aug. 30, 1940 on Cullasaja River
June 1949 on Cartoogechaye Cr.
Maximum Probable Flood
M-11 Miles above mouth
Cross Sections
2024 Ground Elevation in feet (1936 Suppl. Adj.)
Contour interval 40 feet
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH
FLOODED AREAS
CULLASAJA RIVER AND CARTOOGECHAYE CREEK
VICINITY OF FRANKLIN, N.C.
SCALE 0 1000 2000 FEET
MARCH 1963

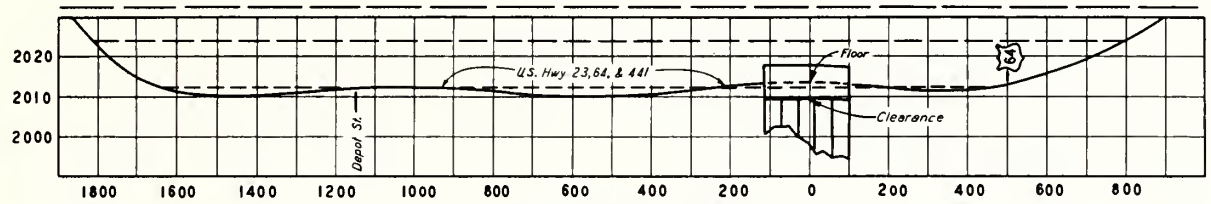




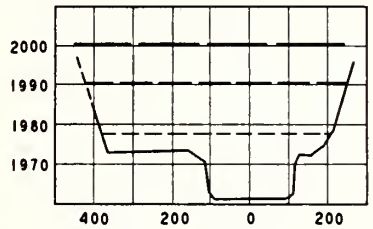
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

HIGH WATER PROFILES
CULLASAJA RIVER
AND
CARTOOGECHAYE CREEK
VICINITY OF
FRANKLIN, N.C.

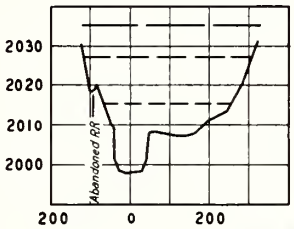
MARCH 1963



SECTION 16-MILE 116.55



SECTION 6-MILE 111.60



SECTION 20-MILE 117.98

LEGEND:

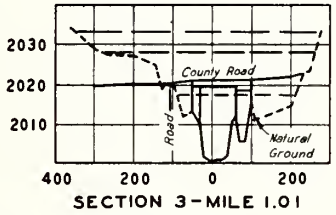
——— ——— Maximum Probable Flood

— — — — Regional Flood

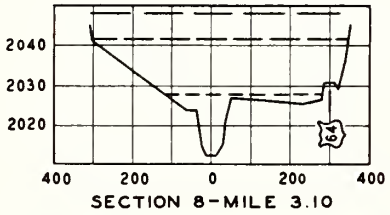
– – – – – – August 30,1940 on Little Tenn. and Cullasaja Rivers. June 1949 on Cartoogechaye Creek.

21 sections not shown

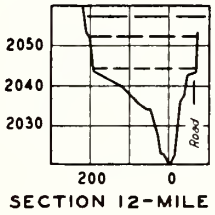
LITTLE TENNESSEE RIVER



SECTION 3-MILE 1.01



SECTION 8-MILE 3.10

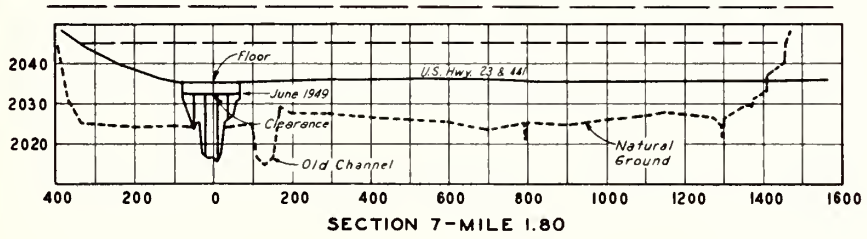


SECTION 12-MILE 4.23

9 sections not shown

CULLASAJA RIVER

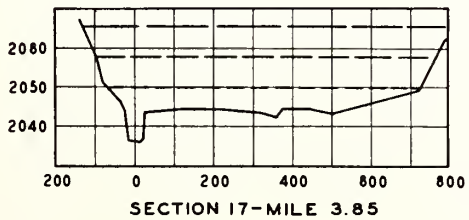
ELEVATION IN FEET (USC & GS 1936 SUPPL. ADJ.)



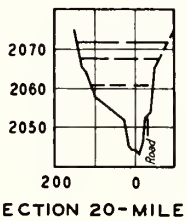
SECTION 7-MILE 1.80

Sections taken looking downstream.

Elevations of Maximum Probable and Regional Floods computed by Flood Control Branch.



SECTION 17-MILE 3.85



SECTION 20-MILE 4.71

19 sections not shown

HORIZONTAL DISTANCE IN FEET

CARTOOGECHAYE CREEK

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
HYDRAULIC DATA BRANCH

CROSS SECTIONS

LITTLE TENN. & CULLASAJA RIVERS
AND
CARTOOGECHAYE CREEK
VICINITY OF
FRANKLIN, N.C.

MARCH 1963

PLATE II

Cullasaja

Historic flood profiles and magnitude of
Regional Flood by Hydraulic Data Branch.

BUCKEYE KLASP—8¼ X 11¼
KAROLTON ENVELOPE DIVISION
KIMBERLY-CLARK CORPORATION
WEST CARROLLTON, OHIO NO. 87